Biological Assessment Report

East Fork Black River Macroinvertebrate Community Assessment

2009 Sample Data Annual Report

Reynolds County, Missouri

May 2012

Prepared for:

Missouri Department of Natural Resources
Division of Environmental Quality
Water Protection Program
Water Pollution Branch

Prepared by:

Missouri Department of Natural Resources
Division of Environmental Quality
Environmental Services Program
Water Quality Monitoring Section

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1.0 Introduction

As part of a post-settlement agreement between the Missouri Department of Natural Resources and Ameren UE following the December 2005 Upper Taum Sauk Reservoir collapse, the Environmental Services Program's (**ESP**) Water Quality Monitoring Section (**WQMS**) continues to assess water quality and the macroinvertebrate community in the East Fork Black River (**East Fork, EFBR**). As in previous studies (Sarver and Michaelson 2005, Michaelson 2007, 2009, 2010), macroinvertebrate and water quality samples were collected in the vicinity of Johnson's Shut-Ins State Park (**JSISP**) and the Lower Taum Sauk Reservoir. Dave Michaelson, Brian Nodine, and Dave Gullic collected spring macroinvertebrate samples from these stations on March 24-25, 2009. Dave Gullic collected all water quality samples from these sites at this time. Dave Michaelson and Brian Nodine collected fall macroinvertebrates and water quality samples on September 22-23, 2009.

2.0 Study Area

The East Fork Black River watershed originates in northeastern Iron County near Graniteville, Missouri and Elephant Rocks State Park. It flows southwest from its source to the Imboden Fork confluence just north of Johnson's Shut-Ins State Park. From this point, it flows south through JSISP and the AmerenUE Lower Taum Sauk Reservoir to its confluence with the Black River near Lesterville, Missouri (see map, Appendix A). The approximately 94-mi^2 watershed is mostly rural, with 92% composed of forested land cover (Table 1). The assessed stream reach is classified in the Missouri Water Quality Standards (MDNR 2010j) as a Class P stream, with designated uses that include Livestock and Wildlife Watering, Protection of Warm Water Aquatic Life, Whole Body Contact, and Drinking Water Supply.

The East Fork Black River is located within the Ozark/Black/Current Ecological Drainage Unit (**EDU**). An EDU is a region in which biological communities and habitat conditions can be expected to be similar. A map of the sampling locations can be found in Appendix A. Table 1 compares the land cover percentages from the Ozark/Black/Current EDU and the 14-digit Hydrologic Unit Code (**HUC**) that contain the sampling reaches of the East Fork Black River. Percent land cover data were derived from Thematic Mapper satellite images from 2000-2004 and interpreted by the Missouri Resource Assessment Partnership (**MoRAP**).

Table 1
Percent Land Cover

	Urban	Crops	Grassland	Forest
Ozark/Black/Current EDU	1.0	0.0	23.0	72.0
HUC 14 #11010007030002 (Hwy 21 – Hwy N)	0.0	0.0	4.0	91.0
HUC 14 #11010007030001 (Upstream of Hwy N)	0.0	0.0	4.0	93.0

3.0 Site Descriptions

All of the following sample sites were in Reynolds County, Missouri.

East Fork Black River Station #1 (SE ¼ sec. 16, T. 32 N., R. 2 E.) was the most downstream station on East Fork Black River and was located immediately upstream of the Highway 21 bridge in Lesterville, Missouri. Geographic coordinates of the downstream terminus of the sampling reach are UTME 692107, UTMN 4147245.

East Fork Black River Station #2 (NW ¼ sec. 9, T. 32 N., R. 2 E.) was located in the vicinity of Wicks Cave, north of Lesterville, Missouri. Geographic coordinates collected near the midpoint of the sampling reach are UTME 691135, UTMN 4149194.

East Fork Black River Station #3 (SW ¼ sec. 33, T. 33 N., R. 2 E.) was located downstream of the Lower Taum Sauk Reservoir spillway. Geographic coordinates of the upstream terminus of the sampling reach are UTME 691167, UTMN 4151896.

East Fork Black River Station #4 (SW ¼ sec. 21, T. 33 N., R. 2 E.) was located upstream of the AmerenUE "bin wall," a water-permeable metal wall that acts as a sieve to prevent bedload material from entering the Lower Reservoir. Geographic coordinates of the downstream terminus of the sampling reach are UTME 691085, UTMN 4155444.

East Fork Black River Station #5 (SW ¼ sec. 16, T. 33 N., R. 2 E.) was located immediately upstream of the shut-ins at Johnson's Shut-Ins State Park. Geographic coordinates of the downstream terminus of the sampling reach are UTME 690836, UTMN 4156925.

East Fork Black River Station #6 (NW ¼ sec. 16, T. 33 N., R. 2 E.) is the restored river reach within Johnson's Shut-Ins State Park, located between Highway N and the Station 5 upstream terminus. Geographic coordinates of the upstream terminus of the sampling reach are UTME 690586, UTMN 4157636.

East Fork Black River Station #7 (NW ¼ sec. 16, T. 33 N., R. 2 E.) was located on a secondary high flow channel that was the main conveyance of EFBR flow immediately following the reservoir breach and during river channel restoration activities. Sampling at this station ended with the spring 2007 sample season after the restored reach was opened. Geographic coordinates of the upstream terminus of the sampling reach are UTME 690586, UTMN 4158170.

East Fork Black River Station #8 (S ½ sec. 4, T. 33 N., R. 2 E.) was located upstream from the Imboden Fork confluence. This reach was outside the area of influence resulting from the Upper Taum Sauk Reservoir failure and was considered a control reach. Geographic coordinates of the upstream terminus of the sampling reach are UTME 690756, UTMN 4159120.

4.0 Methods

4.1 Macroinvertebrate Collection and Analyses

A standardized sample collection procedure was followed as described in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (**SMSBPP**) (MDNR 2010g). A total of three standard habitats--flowing water over coarse substrate (riffles and runs), depositional substrate in non-flowing water (pools), and rootmat at the stream edge--were sampled at all East Fork Black River sites.

A standardized sample analysis procedure was followed as described in the SMSBPP. The following four metrics were used: 1) Taxa Richness (**TR**); 2) total number of taxa in the orders Ephemeroptera, Plecoptera, and Trichoptera (**EPTT**); 3) Biotic Index (**BI**); and 4) Shannon Diversity Index (**SDI**). These metrics were scored and combined to form the Macroinvertebrate Stream Condition Index (**MSCI**). Macroinvertebrate Stream Condition Indices between 20-16 qualify as fully biologically supporting, between 14-10 are partially supporting, and 8-4 are considered non-supporting of the protection of warm water aquatic life designated use. The multi-habitat macroinvertebrate data are presented in Appendix B as laboratory bench sheets.

Although the MSCI score is normally based on multi-habitat data, criteria can be calculated on an individual habitat basis. The goal for calculating single-habitat criteria was to determine whether a differential effect existed among the multiple habitats sampled in this study. Investigating single-habitat criteria allows more precise judgments on the effects to the overall community.

Additionally, macroinvertebrate data were analyzed in the following specific ways. First, comparisons were made among reaches longitudinally. This comparison addresses influences that may result from differential sediment deposition and possible scouring effects among sites within the study reach. Stations located in the river reach downstream of the Lower Taum Sauk Reservoir were grouped for comparison as were stations located upstream of the Lower Reservoir. Macroinvertebrate community attributes that existed prior to the Upper Reservoir failure were compared with conditions as they exist afterward. Data are summarized and presented in tabular format comparing means of the four standard metrics and other parameters at each of the stations sampled in this project.

4.2 Macroinvertebrate Laboratory Processing

Laboratory processing was consistent with the description in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (MDNR 2010g). Each sample was processed under 10x magnification to remove a habitat-specific target number of individuals from debris. Individuals were identified to standard taxonomic levels (MDNR 2010i) and enumerated.

4.3 Physicochemical Data Collection and Analysis

During each survey period, *in situ* water quality measurements were collected at all stations. Field measurements included temperature (MDNR 2010c), dissolved oxygen (MDNR 2009), specific conductance (MDNR 2010b), turbidity (MDNR 2010a), and pH (MDNR 2012a). Additionally, water samples were collected by the WQMS and analyzed by ESP's Chemical Analysis Section for chloride, total phosphorus, ammonia as nitrogen (**NH_3-N**), Nitrite+Nitrate-Nitrogen (**NO_2+NO_3-N**), and total nitrogen (all parameters reported in mg/L). Procedures outlined in Field Sheet and Chain of Custody Record (MDNR 2010d) and Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations (MDNR 2011) were followed when collecting water quality samples.

Stream velocity was measured at each station where practicable during the study using a Marsh-McBirney Flo-Mate™ Model 2000 flow meter. Discharge was calculated per the methods in the Standard Operating Procedure MDNR-ESP-113, Flow Measurement in Open Channels (MDNR 2010e), with the exception that spring 2009 discharge for East Fork Black River Stations 1, 2, 3, 5, and 6 were based on USGS gaging station data (gaging station #07061300 for EFBR Station 1, #07061290 for EFBR Stations 2 and 3, and #07061270 for EFBR Stations 5 and 6). In the past, flow has been measured at Stations 2 and 5 using a Marsh-McBirney meter, but due to high flows resulting from heavy rains, conditions were too dangerous to attempt instream measurement during spring sampling. In fall 2009, flow at Stations 2 and 5 were measured using methods outlined in SOP MDNR-ESP-113.

Physicochemical data were summarized and presented in tabular form for comparison among stations (Table 2, Table 3, Table 4, and Table 5).

4.4 Quality Assurance/Quality Control (QA/QC)

4.4.1 Field Meters

All field meters used to collect water quality parameters were maintained in accordance with the Standard Operating Procedure MDNR-ESP-213, Quality Control Procedures for Checking Water Quality Field Instruments (MDNR 2010f).

4.4.2 Biological Samples

Steps to assure accuracy of organism removal from sample debris were performed consistent with those methods found in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (MDNR 2010g).

4.4.3 Biological Data Entry

All macroinvertebrate data were entered into the WQMS macroinvertebrate database consistent with the Standard Operating Procedure MDNR-ESP-214, Quality Control Procedures for Data Processing (MDNR 2012b).

5.0 Data Results

5.1 Physicochemical Data

Flow and non-nutrient water quality parameters of East Fork Black River sites sampled in spring 2009 are presented in Table 2, with fall 2009 data in Table 3. Discharge from the Lower Reservoir was similar to the upstream East Fork reach on March 24, 2009. During the late afternoon of that day, a severe thunderstorm passed through the area and the river rose substantially overnight. Discharge was measured at Stations 2, 3, and 4 on March 24 before the storm arrived, whereas discharge at the remaining stations was measured (or taken from online USGS gaging station data) on March 25, 2009. Compared to the sample collected at Station 4 on March 24, samples collected from stations upstream of the Lower Reservoir following the river rise exhibited a decrease in temperature and conductivity and an increase in turbidity. Among the downstream stations, water quality field parameters of Station 1 were similar to those of Stations 2 and 3, despite the increased flow.

Flow was also somewhat elevated at the time fall samples were collected (Table 3). According to the USGS gage at Highway 21, discharge at the East Fork Black River was <10 cfs during the week prior to sample collection, but discharge was approximately 100 cfs on September 25, 2009 when water quality and macroinvertebrate samples were collected. Although flow measurements and gage readings for the remaining stations were variable, they appeared to be consistently higher than the previous week and most were higher than in past fall sample seasons. As with discharge readings, water quality field parameters were variable among stations (Table 3). In terms of water chemistry, it appears as though the survey reach was in a state of flux at the time samples were collected.

Table 2
Spring 2009 Flow and *In situ* Water Quality Measurements

	Parameter					
Station	Flow (cfs)	Temperature (˚C)	Dissolved O_2 (mg/L)	Conductance (µS/cm)	pH	Turbidity (NTU)
EFBR #1	360*	11.9	10.6	112	7.83	4.91
EFBR #2	29**	11.5	10.4	116	7.79	3.22
EFBR #3	31**	10.9	10.4	110	7.75	4.98
EFBR #4	21.2	12.9	10.0	174	7.98	1.00
EFBR #5	206†	9.3	10.8	120	7.73	7.27
EFBR #6	210†	9.3	10.9	114	7.85	5.31
EFBR #8	80.2	9.6	10.9	112	7.82	5.89

*USGS Gaging Station data at Hwy. 21 used for Station 1.
**USGS Gaging Station data at the Lower Taum Sauk Reservoir dam used for Station 2 and Station 3.
†USGS Gaging Station data at Hwy. N used for Station 5 and Station 6.

Table 3
Fall 2009 Flow and *In situ* Water Quality Measurements

Station	Flow (cfs)	Temperature (˚C)	Dissolved O_2 (mg/L)	Conductance (µS/cm)	pH	Turbidity (NTU)
EFBR #1	107*	22.0	7.2	152	7.6	1.06
EFBR #2	50.4	24.5	8.6	140	8.1	0.90
EFBR #3	65**	24.0	7.9	136	7.8	1.20
EFBR #4	80.0	20.5	8.3	143	8.1	3.85
EFBR #5	26.6	21.0	8.0	196	8.1	1.56
EFBR #6	25†	22.0	8.0	195	8.0	1.11
EFBR #8	7.8	22.5	7.8	233	8.3	0.25

*USGS Gaging Station data at Hwy. 21 used for Station 1.
**USGS Gaging Station data at the Lower Taum Sauk Reservoir dam used for Station 3.
†USGS Gaging Station data at Hwy. N used for Station 6.

Nutrient and chloride concentrations are presented in Table 4 (spring 2009) and Table 5 (fall 2009). Nutrient parameters tended to be fairly consistent among sites in spring 2009. Ammonia as nitrogen was below detectable limits at all but Station 8 which, although measureable, was below laboratory Practical Quantitation Limits (**PQL**). Nitrite+Nitrate-Nitrogen and total nitrogen concentrations were slightly higher among stations downsteam of the Lower Reservoir compared to upstream samples. Total phosphorus was below detectable concentrations at all stations except Station 2. Chloride concentrations were below the PQL at all stations.

Ammonia as nitrogen was below detectable limits at all but Station 4 in fall 2009 (Table 5). Nitrite+Nitrate-Nitrogen was below detectable levels at all downstream stations and the uppermost Station 8. For stations toward the middle of the survey reach, NO_2+NO_3-N were present in concentrations above the PQL. Total nitrogen was present but below the PQL at all sites except Station 4, where it was above the PQL. Total phosphorus was below detectable concentrations at all stations, and chloride was present but below the PQL at all stations.

Table 4
Spring 2009 East Fork Black River Watershed Nutrient Concentrations

	Parameter (mg/L)				
Station	NH_3-N	NO_2+NO_3-N	Total Nitrogen	Total Phosphorus	Chloride
EFBR #1	*	0.05	0.14	*	1.63**
EFBR #2	*	0.06	0.14	0.09	1.77**
EFBR #3	*	0.06	0.14	*	1.75**
EFBR #4	*	0.01**	0.06	*	2.01**
EFBR #5	*	0.04**	0.12	*	1.72**
EFBR #6	*	0.02**	0.12	*	1.60**
EFBR #8	0.03**	0.02**	0.12	*	1.68**

*Below detectable limits
**Estimated value, detected below Practical Quantitation Limits

Table 5
Fall 2009 East Fork Black River Watershed Nutrient Concentrations

	Parameter (mg/L)				
Station	NH_3-N	NO_2+NO_3-N	Total Nitrogen	Total Phosphorus	Chloride
EFBR #1	*	*	0.16**	*	1.36**
EFBR #2	*	*	0.14**	*	1.29**
EFBR #3	*	*	0.16**	*	1.31**
EFBR #4	0.06	0.20	0.29	*	1.53**
EFBR #5	*	0.10	0.17**	*	1.83**
EFBR #6	*	0.09	0.18**	*	1.82**
EFBR #8	*	*	0.09**	*	2.06**

*Below detectable limits
**Estimated value, detected below Practical Quantitation Limits

5.2 Biological Assessment

Metrics and scores calculated for the East Fork Black River were compared to biological criteria based on reference sites from the Ozark/Black/Current EDU. Criteria for spring and fall sample seasons--presented in Tables 6 and 7--were used to assess the overall health of the aquatic communities within the EDU.

Table 6
Biological Criteria for Warm Water Reference Streams in the Ozark/Black/Current EDU, Spring Season

	Score = 5	Score = 3	Score = 1
TR	>91	91-45	<45
EPTT	>31	31-15	<15
BI	<5.4	5.4-7.7	>7.7
SDI	>3.29	3.29-1.65	<1.65

Table 7
Biological Criteria for Warm Water Reference Streams in the Ozark/Black/Current EDU, Fall Season

	Score = 5	Score = 3	Score = 1
TR	>83	83-41	<41
EPTT	>25	25-13	<13
BI	<5.1	5.1-7.5	>7.5
SDI	>3.27	3.27-1.63	<1.63

5.2.1 East Fork Black River Downstream of Lower Taum Sauk Reservoir

Although spring 2009 MSCI scores tended to decline as stations downstream of the Lower Reservoir neared the dam (Table 8), there were no trends among individual metrics. Macroinvertebrate Stream Condition Index scores were highest at Station 1 and lowest at Station 3, which was the only site to rank partially biologically supporting. Although Taxa Richness was highest at Station 3, the remaining biological metrics were relatively low, resulting in a low MSCI score. Biotic Index values were similar at Station 1 and Station 2. At Station 3, however, Biotic Index values were higher than the other downstream stations, which resulted in a lower score for this metric. The Shannon Diversity Index score also was lower at Station 3 compared to the other downstream stations.

Table 8
Metric Values and Scores for Lower East Fork Black River Stations, Spring 2009 Season, Using Ozark/Black/Current Biological Criteria Reference Data

Site	TR	EPTT	BI	SDI	MSCI	Support
#1 Value	93	34	5.1	3.58		
#1 Score	5	5	5	5	20	**Full**
#2 Value	90	31	5.0	3.65		
#2 Score	3	3	5	5	16	**Full**
#3 Value	99	29	6.2	3.06		
#3 Score	5	3	3	3	14	**Partial**
Biocriteria Score = 5	>91	>31	<5.4	>3.29	20-16	**Full**
Biocriteria Score = 3	91-45	31-15	5.4-7.7	3.29-1.65	14-10	**Partial**
Biocriteria Score = 1	<45	<15	>7.7	<1.65	8-4	**Non**

No discernible pattern was evident among fall 2009 lower river biological metric values and scores (Table 9). Stations 1 and 2 each had a fully supporting MSCI score of 18, with Station 3 having a partially supporting score of 14. Taxa Richness, EPT Taxa, and SDI values all were lower and the Biotic Index value was higher at Station 3. Station 2 had the highest Taxa Richness and the highest number of EPT Taxa among downstream stations.

Table 9
Metric Values and Scores for Lower East Fork Black River Stations, Fall 2009 Season, Using Ozark/Black/Current Biological Criteria Reference Data

Site	TR	EPTT	BI	SDI	MSCI	Support
#1 Value	84	27	5.8	3.66		
#1 Score	5	5	3	5	18	**Full**
#2 Value	96	30	5.6	3.58		
#2 Score	5	5	3	5	18	**Full**
#3 Value	74	20	6.8	3.35		
#3 Score	3	3	3	5	14	**Partial**
Biocriteria Score = 5	>83	>25	<5.1	>3.27	20-16	**Full**
Biocriteria Score = 3	83-41	25-13	5.1-7.5	3.27-1.63	14-10	**Partial**
Biocriteria Score = 1	<41	<13	>7.5	<1.63	8-4	**Non**

To assess potential habitat and benthic sediment distribution changes that may occur over time in the lower East Fork, habitat-specific biological criteria comparisons of pre- versus post-event metric scores are presented in Table 10 and Table 11. When comparing single habitat scores over the years, it appears that rootmat at Station 3 continues to be the weakest contributing habitat in the fall, whereas coarse substrate is consistently low in spring samples. Although Station 3 samples from both 2009 seasons had partially supporting MSCI scores, two individual habitats from each season were fully supporting. In the spring sample the coarse substrate portion was partially supporting, whereas in the fall sample the rootmat portion was partially supporting. For Stations 1 and 2, rootmat achieved a top score in spring, but had only a partially supporting score in fall. With the exception of the fall rootmat scores and the spring Station 1 coarse substrate score, each of the remaining habitats at Stations 1 and 2 had fully supporting scores.

Table 10
Lower East Fork Black River
Single Habitat Stream Condition Index Scores--Spring Sample Seasons

		EF Black R. #1				EF Black R. #2				EF Black R. #3			
Habitat ↓	Year→	06	07	08	09	06	07	08	09	06	07	08	09
Coarse Substrate		12	16	18	14	16	16	14	20	12	12	12	12
Non-Flow		12	16	18	18	18	10	16	16	18	10	16	16
Rootmat		14	18	20	20	14	16	18	20	14	10	14	16
MSCI Score		12	18	18	20	16	16	18	16	12	12	12	14

Table 11
Lower East Fork Black River
Single Habitat Stream Condition Index Scores--Fall Sample Seasons

		EF Black R. #1					EF Black R. #2					EF Black R. #3				
Habitat ↓	Year→	05	06	07	08	09	05	06	07	08	09	05	06	07	08	09
Coarse Substrate		20	18	18	18	18	18	18	18	20	18	14	18	18	14	16
Non-Flow		16	20	16	18	18	18	20	18	20	20	18	12	18	16	20
Rootmat		14	16	12	18	14	12	12	12	18	14	12	12	12	14	14
MSCI Score		18	18	18	18	18	16	18	18	20	18	12	14	16	12	14

5.2.2 East Fork Black River Upstream of Lower Taum Sauk Reservoir

Each of the four stations upstream of the Lower Taum Sauk Reservoir attained fully supporting status in spring 2009 (Table 12). Stations 4 and 8 each achieved the highest possible MSCI score, with each biological metric meeting fully supporting criteria. Although the two stations within JSISP, Stations 5 and 6, were fully supporting, certain individual metrics scored somewhat lower. Taxa Richness and the number of EPT Taxa were lower than what was required for a top score at Station 5, and at Station 6 EPT Taxa and Biotic Index were scored lower. Station 6 had a single taxon less than what was required for a top score in the EPT Taxa metric, and the Biotic Index value was 0.2 units higher than what was required for a top score.

Table 12
Metric Values and Scores for Upper East Fork Black River Stations, Spring 2009 Season, Using Ozark/Black/Current Biological Criteria Reference Data

Site	TR	EPTT	BI	SDI	MSCI	Support
#4 Value	92	35	5.2	3.72		
#4 Score	5	5	5	5	20	**Full**
#5 Value	88	25	5.3	3.80		
#5 Score	3	3	5	5	16	**Full**
#6 Value	99	31	5.5	3.87		
#6 Score	5	3	3	5	16	**Full**
#8 Value	104	33	4.8	3.83		
#8 Score	5	5	5	5	20	**Full**
Biocriteria Score = 5	>91	>31	<5.4	>3.29	20-16	**Full**
Biocriteria Score = 3	91-45	31-15	5.4-7.7	3.29-1.65	14-10	**Partial**
Biocriteria Score = 1	<45	<15	>7.7	<1.65	8-4	**Non**

With the exception of Station 8, each of the four stations located upstream of the Lower Reservoir scored fully supporting in fall 2009 (Table 13). Only Station 5 achieved the highest score for each of the biological metrics; the remaining stations with fully supporting scores had slightly higher Biotic Index scores, which resulted in the difference

in MSCI scores. Station 8, which had a partially supporting MSCI score, had lower Taxa Richness and EPT Taxa values among the upstream stations in fall 2009.

Table 13
Metric Values and Scores for Upper East Fork Black River Stations, Fall 2009 Season, Using Ozark/Black/Current Biological Criteria Reference Data

Site	TR	EPTT	BI	SDI	MSCI	Support
#4 Value	94	32	5.4	3.77		
#4 Score	5	5	3	5	18	**Full**
#5 Value	98	28	5.0	3.67		
#5 Score	5	5	5	5	20	**Full**
#6 Value	98	29	5.5	3.80		
#6 Score	5	5	3	5	18	**Full**
#8 Value	82	24	5.7	3.77		
#8 Score	3	3	3	5	14	**Partial**
Biocriteria Score = 5	>83	>25	<5.1	>3.27	20-16	**Full**
Biocriteria Score = 3	83-41	25-13	5.1-7.5	3.27-1.63	14-10	**Partial**
Biocriteria Score = 1	<41	<13	>7.5	<1.63	8-4	**Non**

5.3 East Fork Black River Macroinvertebrate Community Composition

Macroinvertebrate Taxa Richness, EPT Taxa, and percent EPT are presented in Tables 14 and 15. These tables also provide percent composition data for the five dominant macroinvertebrate families at each East Fork Black River station. The percent relative abundance data were averaged from the sum of three macroinvertebrate habitats--coarse substrate, nonflow, and rootmat--sampled at each station.

Spring 2009 Sample Season

Macroinvertebrates were relatively sparse at Stations 5, 6, and 8. Habitat-specific target numbers of individuals were not reached for two habitats at Stations 5 and 6. Although the Station 8 sample reached target numbers for two of the three habitats, the non-flow portion required processing half of the habitat sample (the upper limit of laboratory subsampling) to achieve the target. Non-flow and rootmat samples required a 50 percent subsample at Stations 6 and 8, whereas coarse substrate and rootmat required 50 percent at Station 5.

Spring 2009 macroinvertebrate samples from East Fork Black River averaged 95 total taxa (range 88-104) and 31 EPT Taxa (range 25-34) (Table 14). Midge larvae (Chironomidae) were the dominant taxa group at all stations by a considerable margin. Chironomids alone accounted for roughly half of individuals among all East Fork samples, except that they were slightly less abundant at Station 8. Stations 1 and 2 had a nearly identical top five abundant taxa list with heptageniid and isonychiid mayflies and

riffle beetles (Elmidae) being prevalent. The remaining stations had a wider diversity of taxa that made up the top five dominant families list.

Station 4 had the highest number of mayfly taxa (N=17), followed closely by Station 1, which had 16 mayfly taxa. Stations 3 and 5 had the fewest mayfly taxa, with 12 each. Mayflies in the family Baetidae tended to be more abundant and represented by more taxa in stations upstream of the Lower Reservoir. No such trends were observed among the remaining mayfly families. Generally, mayflies were present in comparable numbers and taxa richness, with the exception that Stations 3 and 5 tended to have lower mayfly abundance within families compared to the remaining sites.

Stoneflies were distributed in similar abundance among stations in spring 2009, with the exception of Station 3 and Station 8. Station 3 had the lowest number of individuals of any of the East Fork stations but did not have the lowest stonefly diversity. Whereas Station 3 had one individual in each of six taxa, Station 4 had only four taxa. Although Station 4 had fewer stonefly taxa, this station had a greater abundance of each taxon. Station 8 had the greatest abundance of stoneflies, which accounted for 10.3 percent of the overall sample, a percentage roughly twice the next nearest stonefly abundance at Station 6. The majority of stoneflies at Station 8 (87.7 percent) were immature Leuctridae.

There was little variability in the number of caddisfly taxa among stations in spring 2009. The lowest diversity occurred at Station 5 (seven taxa), with the highest being at Station 4 (13 taxa). Despite Station 3 having relatively few caddisfly taxa (eight), it had the highest number of individuals among stations. The highest percentage of caddisflies in samples occurred at Station 3 and Station 4, each with 11.1 percent. The genus *Cheumatopsyche* was the dominant caddisfly taxon at all but the two downstream stations. Nearly 80 pecent of caddisflies present in the Station 3 sample was *Cheumatopsyche*; this genus accounted for between roughly 40 and 63 percent of caddisflies in Stations 4 through 8.

Riffle beetle (Elmidae) taxa and abundance were distributed similarly among stations located upstream of the Lower Reservoir. Each of the upstream stations had three elmid taxa: *Dubiraphia*; *Optioservus sandersoni*; and *Stenelmis*. Among stations downstream of the Lower Reservoir, Station 1 had five elmid taxa and Station 2 had four. A single *Macronychus glabratus* individual at Station 1 accounted for the additional taxon. Station 3 had relatively few elmid taxa, but one of the two that were present (*Stenelmis*) was present in numbers comparable to the remaining downtream stations. The other elmid genus found at Station 3, *Dubiraphia*, was present in numbers lower than Station 1 or 2 but roughly comparable to the upstream sites.

Of the remaining taxa groups, few notable patterns were observed. Aquatic worms (Oligochaeta) were present in varying abundance and diversity, with the highest numbers of individuals occurring at Stations 1 and 6. Stations 1, 3, 5, and 6 each had four

oligochaete taxa; each of the remaining stations had fewer. The Asian clam *Corbicula* was found only in stations downstream of the Lower Reservoir, as were fingernail clams (Pisidiiae). No stations had mollusks in great abundance. A total of 59 chironomid genera, species, and species groups were found in spring 2009 samples. The highest number of chironomids was present at Station 3 and made up nearly 70 percent of the sample. Station 3 also had the greatest diversity of chironomids with 39 taxa present, although a single genus (*Rheotanytarsus*) accounted for nearly 41 percent of the family. In addition to *Rheotanytarsus*, other abundant chironomid taxa common to all sample sites included *Cricotopus*/*Orthocladius* and *Tanytarsus.*

Table 14
Spring 2009 East Fork Black River Macroinvertebrate Composition

↓Variable Station→	1	2	3	4	5	6	8
Taxa Richness	93	90	99	92	88	99	104
Number EPT Taxa	34	31	29	35	25	31	33
% Ephemeroptera	21.3	21.9	6.7	15.6	13.2	16.1	13.7
% Plecoptera	3.9	3.1	0.3	5.6	5.5	3.9	10.3
% Trichoptera	5.4	9.4	11.1	11.1	5.7	6.8	8.5
MSCI Score	20	16	14	20	16	16	20
% Dominant Families							
Chironomidae	46.3	45.6	68.9	49.9	49.2	56.3	38.7
Simuliidae	10.8	--	3.2	--	7.1	--	8.8
Heptageniidae	6.8	5.2	--	4.9	3.1	--	--
Isonychiidae	6.6	8.2	--	--	--	--	--
Elmidae	6.1	10.1	2.0	--	--	--	--
Caenidae	--	5.6	--	5.1	6.9	4.6	--
Hydropsychidae	--	--	8.8	7.1	--	3.5	5.4
Planariidae	--	--	2.2	--	--	--	--
Perlidae	--	--	--	4.8	--	--	--
Ceratopogonidae	--	--	--	--	5.4	--	5.3
Baetidae	--	--	--	--	--	2.9	--
Leuctridae	--	--	--	--	--	--	9.0

<u>Fall 2009 Sample Season</u>

Unlike the spring sample season, few samples failed to reach the target number of individuals for each habitat. Station 4 and Station 8 each had a single habitat with fewer than the target number of organisms in the subsample. Although 50 percent of the Station 8 rootmat sample was processed in an attempt to reach the target number, the failure of the Station 4 nonflow sample to reach the target number was due to a discrepancy in laboratory processing. Based on laboratory records, it appears that not all specimens retained during processing could be identified to the required taxonomic level, which led to a failure to reach the target number for that habitat. Although the macroinvertebrate total in the Station 4 nonflow was below the target, the underage was

slight (N = 236, whereas the goal was N = 300) and the overall sample achieved a fully supporting MSCI score (Table 15). It should be noted, therefore, that macroinvertebrate abundance was not a factor limiting target numbers or metrics during the fall 2009 sample season.

Fall 2009 macroinvertebrate samples from East Fork Black River averaged 89 taxa (range 74-98) and 27 EPT Taxa (range 20-39) (Table 15). Although chironomid larvae were the dominant taxa group at each station, they were not as overwhelmingly dominant as in the spring samples. Whereas chironomids made up nearly half or more of most spring samples, only Stations 3 and 4 had chironomid abundance approaching half the sample. Abundance among macroinvertebrates in fall tended to be distributed over a wider variety of taxa such as elmids, heptageniid mayflies, and caenid mayflies.

Station 4 had the highest number of mayfly taxa (N=20), followed by Stations 1, 5, and 6, each of which had 19 mayfly taxa. Each of the sample stations had between 18 and 20 mayfly taxa, with the exception that Station 3 had 13 and Station 8 had 16. As was the case in spring, mayflies in the family Baetidae tended to be slightly more abundant among samples collected upstream of the Lower Reservoir. The mayfly family Leptohyphidae also followed this trend. Conversely, mayflies in the family Caenidae were more abundant among downstream stations, with Station 3 having more than twice the number of caenid individuals than the next nearest sample. Mayflies in the families Heptageniidae and Isonychiidae were present in similar abundance among stations, with the exception that fewer individuals in these families were present at Station 3. Station 3 also had the lowest abundance of baetid mayflies among all sites.

Compared to spring, stoneflies were present in low abundance in fall 2009 samples. With the exception of Station 3, each sample had at least a few stoneflies present. Only Station 8, which had the highest number of individuals (N=14), had stoneflies making up more than one percent of the overall sample. Stations 2, 4, and 6 had the highest stonefly taxa richness with each having three stonefly taxa.

Caddisflies tended to make up a higher percentage of the overall sample among stations upstream of the Lower Reservoir compared to the lower river sites. This trend was more pronounced at Stations 4, 5, and 6. Two genera--*Cheumatopsyche* and *Helicopsyche*--were quite abundant at Stations 4, 5, and 6 and were the primary contributors to caddisfly abundance at these sites. *Helicopsyche*, which is a particularly intolerant caddisfly genus, was relatively numerous at Stations 4, 5, and 6, making up between 31 and 50 percent of total caddisflies present. By comparison, *Helicopsyche* was quite rare among downstream stations and was absent at Station 3.

The highest percentage of riffle beetles (Elmidae) was found at Stations 1, 2, and 8. Elmids were represented by comparable numbers of taxa (four or five) at all but Station 3, which had two elmid taxa, and Station 6, which had three. As was the case in spring samples, a single station had five elmid taxa and *Macronychus glabratus* accounted for

Table 15
Fall 2009 East Fork Black River Macroinvertebrate Composition

↓Variable	Station→	1	2	3	4	5	6	8
Taxa Richness		84	96	74	94	98	98	82
Number EPT Taxa		27	30	20	32	28	29	24
% Ephemeroptera		36.0	36.3	26.5	23.0	33.7	28.6	31.6
% Plecoptera		0.3	0.7	--	0.4	0.1	0.7	1.6
% Trichoptera		4.2	4.1	3.9	13.0	13.6	16.1	7.0
MSCI Score		18	18	14	18	20	18	14
% Dominant Families								
Chironomidae		27.6	17.3	45.8	39.6	24.9	23.1	24.6
Elmidae		12.6	15.1	--	7.1	--	--	13.1
Heptageniidae		12.6	7.6	--	9.0	13.7	13.8	16.8
Caenidae		9.0	8.6	18.4	5.3	6.6	--	--
Isonychiidae		7.5	7.6	--	--	10.0	--	--
Coenagrionidae		4.6	--	3.6	--	--	5.6	4.9
Leptohyphidae			10.4	--	--	--	--	--
Planariidae				6.8	--	--	--	--
Ceratopogonidae		--	--	3.9	--	--	--	--
Helicopsychidae		--	--	--	6.4	--	--	--
Hydropsychidae		--	--	--	--	6.3	7.2	--
Hyalellidae		--	--	--	--	--	7.9	--
Baetidae		--	--	--	--	--	--	4.4

the additional taxon. Unlike the fall season, however, this species was found at Station 2 rather than Station 1. Elmid abundance was notably lower in the Station 3 sample than the remaining sites. Also, only two elmid taxa (*Stenelmis* and *Dubiraphia*) were found at Station 3. In the case of *Stenelmis* the number of individuals found in the Station 3 sample was roughly one-tenth of the remaining downstream stations. The other elmid present at Station 3, *Dubiraphia*, was about half as abundant compared to the other two downstream stations.

As was the case for the spring sample season, few patterns were noted for the remaining taxa groups. Aquatic worms (Oligochaeta) were not particularly abundant, with the highest number (N=25) occurring at Station 8. Station 8 also had the greatest number of oligochaete taxa with five. Station 1 had only one mollusk taxon, whereas the remaining stations had between three and six mollusk taxa. The Asian clam *Corbicula* was found only among stations downstream of the Lower Reservoir. When including all East Fork stations, the family Chironomidae was made up of 54 genera, species, and species groups in fall 2009. As in spring samples, the highest number of chironomids occurred at Station 3 and accounted for over 45 percent of the overall sample. Despite this abundance the number of chironomid taxa was comparatively low; only Station 8 had fewer chironomid taxa than Station 3. A single genus, *Tanytarsus*, made up 31 percent of

chironomids at Station 3; among the remaining East Fork stations, chironomid taxa tended to be more evenly distributed.

6.0 Data Trends

This section builds on data trends first presented in the biological assessment of 2007 sample data (Michaelson 2009). Water quality, biological assessment metrics, and macroinvertebrate community composition trends are presented here to show whether changes in these parameters have occurred over time or in response to remediation efforts undertaken in certain reaches of the East Fork Black River.

6.1 Water Quality

Water quality data presented for trend analysis in this section have been separated into two tables for each season. Water quality parameters collected during spring sample seasons are presented in Table 16 (stations downstream of the Lower Reservoir) and Table 17 (upper river). Fall water quality samples are presented in Table 18 (lower river) and Table 19 (upper river).

Nutrient parameters among lower East Fork stations collected in spring have tended to be slightly higher compared to fall samples, but several remain near laboratory lower detection limits. Upper East Fork spring 2009 nutrient concentrations tend to be similar to those of the lower river (Table 17), with none of the parameters or stations exhibiting outliers.

Turbidity was variable among stations in spring 2009 and depended on whether water quality samples were collected before or after the thunderstorm mentioned in Section 4.3 and 5.1. One interesting feature regarding turbidity was noted in the lower river. In previous years, spring turbidity readings increased at least slightly while progressing upstream from Station 1 to Station 3; this was not the case in spring 2009. Spring 2009 turbidity readings among East Fork stations downstream of the Lower Reservoir were lower than any levels since data collection began in 2006, and there was no appreciable difference among these three stations. Water quality samples were collected prior to heavy rains at Stations 2, 3, and 4. Although Station 1 samples were collected after discharge had changed from approximately 30 cfs to 360 cfs overnight, turbidity at Station 1 was similar to the upstream stations, despite the increased flow. In addition, turbidity at Station 1 during these elevated flows was slightly lower in spring 2009 compared to previous years, all of which were collected during much lower flow. One observation made during water quality sample collection since the Upper Reservoir breach is that there is typically a time delay between heavy rains and increased turbidity in the lower river (D. Gullic, Missouri Department of Natural Resources pers. comm. March 7, 2012). It is thought that it takes some time for stormwater to suspend event-related fine sediment in the Lower River, which then results in higher turbidity in the lower river. This pattern was observed in spring 2009, but the increase in turbidity was slight. Prior to the thunderstorm on March 23, turbidity from *in situ* sampling was nearly

Table 16
Lower East Fork Black River Spring Water Quality Parameters

	East Fork Black River											
Station	Station 1				Station 2				Station 3			
Parameter ↓ / Year →	06	07	08	09	06	07	08	09	06	07	08	09
Flow	111	44.0	144	360	108	42.9	144	29	110	53.0	144	31
Temp	8.2	11.0	11.6	11.9	9.1	10.8	11.3	11.5	9.4	11.9	11.6	10.9
D.O.	10.8	10.4	11.0	10.6	10.6	10.9	10.8	10.4	10.9	11.2	11.4	10.4
Cond.	102	143	67	112	99.8	141	66	116	99.2	136	62	110
pH	8.20	7.42	7.8	7.83	8.10	7.69	7.9	7.79	8.05	7.98	7.8	7.75
Turb.	32.3	6.71	7.25	4.91	33.5	7.90	7.27	3.22	37.9	8.97	8.09	4.98
NH_3-N	--	†	†	†	--	†	†	†	--	†	†	†
NO_2+NO_3-N	--	0.04*	0.03*	0.05	--	0.04*	0.02*	0.06	--	0.03*	0.03*	0.06
Ttl. Nitrogen	--	0.08	0.12	0.14	--	0.09	0.12	0.14	--	0.08	0.15	0.14
Ttl. Phos.	--	0.02*	†	†	--	0.02*	†	0.09	--	0.04*	†	†
Chloride	--	1.88*	1.36*	1.63*	--	1.85*	1.35*	1.77*	--	1.92	1.22*	1.75*

† Below detectable limits
* Estimated value, detected below Practical Quantitation Limits

Table 17
Upper East Fork Black River Spring Water Quality Parameters

	East Fork Black River															
Station	Station 4				Station 5				Station 6				Station 8			
Parameter ↓ Year →	06	07	08	09	06	07	08	09	06	07	08	09	06	07	08	09
Flow	164	28.3	115	21.2	170	25.8	116	206	2.1	**	103	210	69.6	13.4	51	80.2
Temp	6.5	11.1	11.0	12.9	6.5	11.3	11.1	9.3	8.7	**	10.9	9.3	6.5	11.0	11.9	9.3
D.O.	11.7	10.7	11.2	10.0	11.3	11.1	12.3	10.8	6.52	**	12.7	10.9	11.8	11.3	10.4	10.9
Cond.	127	145	85	174	123	145	109	120	168	**	87	114	121	132	81	112
pH	7.67	7.90	8.0	7.98	7.70	7.79	8.1	7.73	7.37	**	7.9	7.85	7.77	7.93	7.8	7.82
Turb.	8.81	5.20	1.85	1.00	21.0	14.5	1.53	7.27	35.4	**	1.66	5.31	3.14	1.00	1.60	5.89
NH_3-N	--	†	†	†	--	†	†	†	--	**	†	†	--	†	†	0.03*
NO_2+NO_3-N	--	0.04*	0.04*	0.01*	--	0.05	0.05*	0.04*	--	**	0.04*	0.02*	--	0.02*	0.03*	0.02*
Ttl. Nitrogen	--	0.07	0.11	0.06	--	0.08	0.09	0.12	--	**	0.32	0.12	--	0.05	0.09	0.12
Ttl. Phos.	--	0.02*	†	†	--	0.02*	†	†	--	**	†	†	--	0.01*	†	†
Chloride	--	2.02	1.73*	2.01	--	2.21	1.60*	1.72	--	**	1.75*	1.60*	--	2.16	1.98*	1.68

† Below detectable limits
* Estimated value, detected below Practical Quantitation Limits

5 NTU at Station 3; on March 31, 2009 after two stormwater events, turbidity recorded by the USGS gaging station in the vicinity of Station 3 was 9.6 NTU.

Fall water quality parameters collected downstream of the Lower Taum Sauk Reservoir are given in Table 18, and data for stations upstream of the Lower Reservoir are presented in Table 19. Fall water quality parameters collected between fall 2005 and fall 2009 exhibited fluctuations that are typical of seasonal or diel patterns. Changes among years in flow, temperature, dissolved oxygen, and conductivity can be explained by differences in rainfall patterns; and for the lower East Fork Black River, water release cycles from the Lower Taum Sauk Reservoir.

Although dissolved oxygen concentrations measured *in situ* during both field seasons were well above the 5.0 mg/L threshold for attaining Missouri Water Quality Standards (MDNR 2010), the USGS gaging station downstream of the Lower Reservoir (station #07061290) recorded several days in which dissolved oxygen was as low as 1.9 mg/L. Although each of the low dissolved oxygen readings occurred during late August 2009 when discharge rates were below 2 cfs, average daily temperature for the week was not excessive, ranging between 20-26°C.

Nutrient parameters among lower East Fork stations collected during fall sample seasons continue to be present in very low concentrations. Among the nutrient parameters analyzed for fall 2009, all were present in concentrations either below detectable limits or below PQLs. Although turbidity has been a source of concern for lower East Fork water quality since the 2005 Upper Reservoir failure, each of the lower river fall 2009 turbidity readings were comparable to pre-event levels. In previous years, Station 3 has had higher turbidity levels than either of the other two downstream stations; in fall 2009, however, turbidity readings were relatively consistent among samples collected from downstream stations.

Upper East Fork fall 2009 nutrient concentrations were similar to those of the lower river stations, being present either in concentrations below detectable limits or below laboratory PQLs. Turbidity at Station 4 was slightly higher in fall 2009 compared to previous years but was likely due to elevated flow that was measured during sampling. Turbidity among the remaining upstream stations was fairly consistent compared to one another and was very low.

Table 18
Lower East Fork Black River Fall Water Quality Parameters

	East Fork Black River														
	Station 1					Station 2					Station 3				
Parameter ↓ Year →	05	06	07	08	09	05	06	07	08	09	05	06	07	08	09
Flow	13.4	2.9	90.0	6.0	107	13.6	3.0	54.1	6.0	50.4	13.2	7.1	50.3	4.3	65
Temp	26.0	15.0	22.9	19.9	22.0	26.5	16.5	24.1	19.4	24.5	27.5	16.5	21.7	20.1	24.0
D.O.	7.24	7.54	9.06	8.0	7.2	7.85	8.19	8.76	8.4	8.6	7.34	8.30	8.04	8.7	7.9
Cond.	183	254	136	171	152	183	268	134	171	140	184	273	130	164	136
pH	8.3	7.9	7.77	7.7	7.6	8.3	8.1	7.91	7.7	8.1	8.2	7.7	7.56	7.8	7.8
Turb.	1.00	4.02	5.42	1.00	1.06	1.00	6.66	6.01	1.00	0.90	2.00	53.3	10.2	2.30	1.20
NH_3-N	†	†	†	†	†	†	†	†	†	†	†	0.53	†	†	†
NO_2+NO_3-N	0.03*	0.20	0.09	0.03*	†	0.02*	0.25	0.08	0.03*	†	0.04*	0.08	0.07	†	†
Ttl. Nitrogen	0.09	0.33	0.22	0.10	0.16*	0.25	0.41	0.22	0.11	0.14*	0.15	0.84	0.29	0.16	0.16*
Ttl. Phos.	†	†	†	†	†	†	†	†	†	†	†	†	†	0.01*	†
Chloride	1.57*	2.35*	1.33*	1.39*	1.36*	1.62*	2.33*	1.38*	1.62*	1.29*	1.47*	2.43*	1.34*	1.68*	1.31*

† Below detectable limits
* Estimated value, detected below Practical Quantitation Limits

Table 19
Upper East Fork Black River Fall Water Quality Parameters

	East Fork Black River																
Station	Station 4				Station 5				Station 6					Station 8			
Parameter ↓ Year →	06	07	08	09	06	07	08	09	05	06	07	08	09	06	07	08	09
Flow	3.6	17.9	6.5	80.0	3.6	15.2	7.9	26.6	9.0	0.5	23.0	7.9	25.0	0.6	5.3	7.9	7.8
Temp	20.5	22.6	18.7	20.5	16.0	25.6	18.2	21.0	25.5	23.0	25.4	18.0	22.0	17.0	20.0	17.9	22.5
D.O.	9.80	9.56	9.1	8.3	8.31	8.66	8.8	8.0	7.57	2.27	9.24	8.7	8.0	7.15	7.27	8.5	7.8
Cond.	270	199	235	143	323	202	235	196	220	355	187	215	195	254	183	215	233
pH	8.2	8.11	8.1	8.1	7.6	7.88	7.7	8.1	8.4	7.1	7.99	7.8	8.0	8.0	7.58	7.8	8.3
Turb.	1.00	1.00	1.00	3.85	1.57	1.00	1.00	1.56	2.00	22.2	1.00	52.2	1.11	1.19	1.00	1.00	0.25
NH_3-N	†	†	†	0.06	†	†	†	†	0.06	0.19	†	†	†	†	†	†	†
NO_2+NO_3-N	0.16	0.13	†	0.20	0.09	0.14	0.03*	0.10	†	†	0.11	0.02*	0.09	0.01*	0.15	0.01*	†
Ttl. Nitrogen	0.26	0.19	0.05	0.29	0.14	0.20	0.06	0.17*	0.07	0.20	0.17	0.04*	0.18*	0.06	0.20	0.05	0.09*
Ttl. Phos.	†	†	†	†	†	†	†	†	0.77	†	†	†	†	†	†	†	†
Chloride	2.24*	2.39*	2.13*	1.53*	2.31*	2.49*	2.21*	1.83*	2.00*	2.35*	2.48*	2.52*	1.82*	2.35*	3.04*	2.51*	2.06*

† Below detectable limits
* Estimated value, detected below Practical Quantitation Limits

6.2 Biological Assessment

6.2.1 Biological Metrics

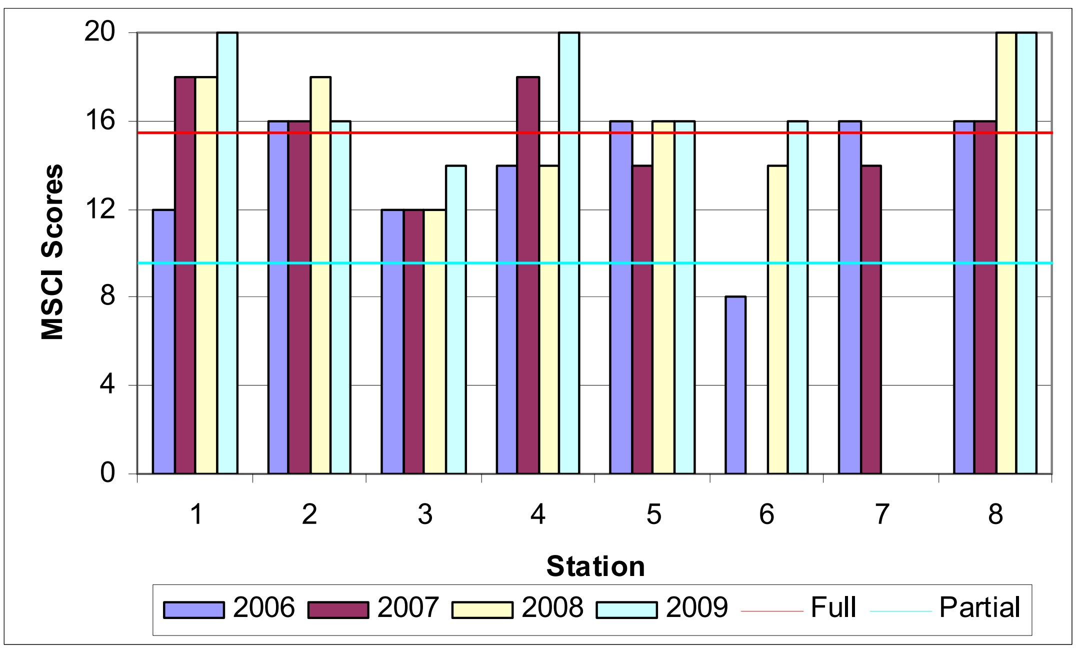
Macroinvertebrate Stream Condition Index scores varied seasonally and by station. In the lower East Fork, pre-event conditions are available only for the fall macroinvertebrate community. Fall samples were collected in 2005 prior to the collapse of the Upper Reservoir as part of another study. In the upper East Fork, the site currently referred to as Station 6 within JSISP represents the same East Fork Black River reach that had been a Biological Criteria Reference site. Samples were collected at this station in fall 2005, spring 2000, fall 2000, spring 1999, and fall 1999. Macroinvertebrate data from these samples will serve as a baseline for future assessment of the river restoration project within JSISP.

In this section, each of the four biological metrics that combine to form the MSCI score is presented individually. Although sampling began in fall 2005, biological metrics and the overall MSCI scores are presented with spring followed by fall data for ease of interpretation by season. Biological metrics and MSCI scores are discussed separately by season and are graphically presented in Figure 1 through Figure 10. Each figure includes horizontal red and blue lines that represent the threshold for partially supporting and fully supporting values, respectively. In the case of the MSCI graphics (Figures 1 and 2), these lines were placed slightly below the actual threshold value to provide easier visual definition between supportability categories.

Spring Macroinvertebrate Stream Condition Index Trends

Spring MSCI scores for stations downstream of the Lower Reservoir were lowest at Station 1 and Station 3 in 2006, where each station achieved an MSCI score of 12 (Figure 1). Although Station 1 achieved only a partially supporting score during the first sample season following the Upper Reservoir breach (spring 2006), it increased to fully supporting status in subsequent years and reached the highest possible MSCI score in 2009. For the first time since this study began, Station 3 achieved a spring MSCI score higher than 12. With an MSCI score of 14 in 2009, however, Station 3 has yet to attain a fully supporting spring score. Station 2 had spring MSCI scores of 16 in 2006 and 2007 but increased to 18 in 2008. In 2009, however, the Station 2 MSCI score returned to 16. Unlike previous years, each of the stations upstream of the Lower Reservoir (Stations 4-8) attained fully supporting MSCI scores in spring 2009. Stations 4 and 8 each achieved the highest possible MSCI score.

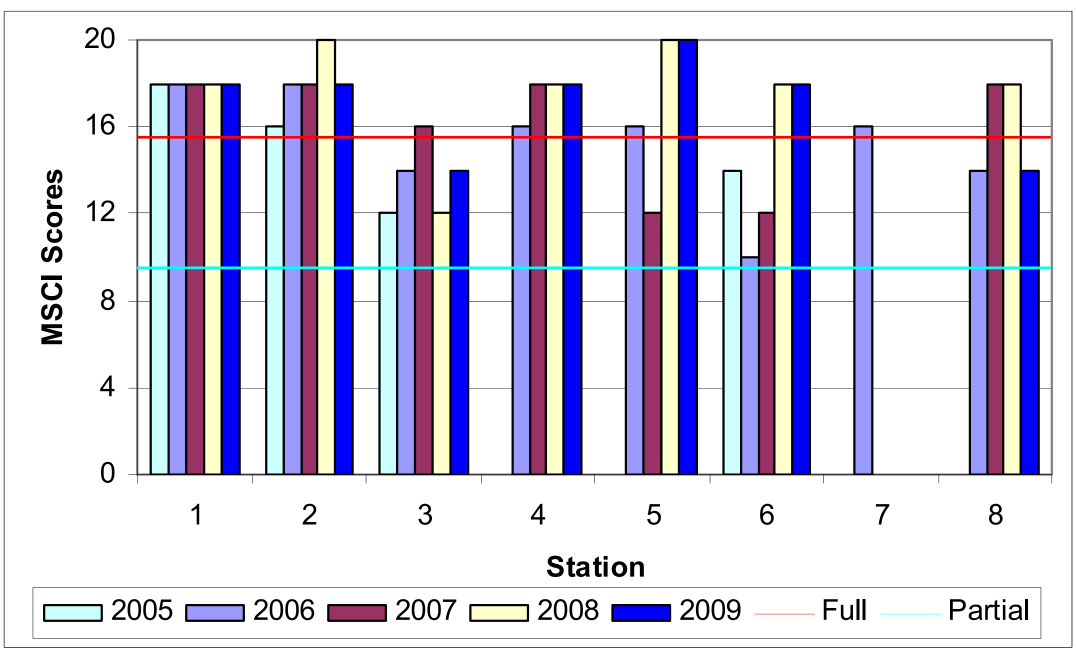
Figure 1
East Fork Black River Spring Macroinvertebrate Stream Condition Index Scores



Fall Macroinvertebrate Stream Condition Index Trends

Among stations downstream of the Lower Reservoir, fall MSCI scores at Stations 1 and 2 consistently have been in the fully supporting range during each of the five fall sample seasons (Figure 2). Station 3, on the other hand, has exhibited considerable variability over this time frame, achieving fully supporting status only once in 2007. Based on this score, Station 3 appeared to demonstrate incremental improvement since the first samples were collected in 2005. With fall MSCI scores of 12 and 14 since then, however, this trend has not continued. With respect to the sites located upstream of the Lower Reservoir (Stations 4-8) only Station 8 failed to attain a fully supporting MSCI score in 2009. Other than Station 8, each of the upstream stations had identical MSCI scores in fall 2008 and 2009. MSCI scores for the two stations within JSISP (Stations 5 and 6) changed from partially supporting in fall 2007 to fully supporting in 2008 and have maintained that level over the course of two fall sample seasons. Fall 2008 appears to mark the beginning of improvement over previous years for stations located within JSISP, particularly at Station 6. The following fall samples are presented for Station 6: 2005 pre-event data; 2006 "West Channel" data during which time the majority of East Fork flow was directed away from the original channel and into the secondary high flow channel of Station 7; and 2007, which represents macroinvertebrate recolonization that occurred between April (when East Fork flow was directed into the newly-constructed channel) and September 2007. Fall 2008 and 2009 Station 6 samples each are representative of at least one year after major in-channel construction activities were completed at JSISP.

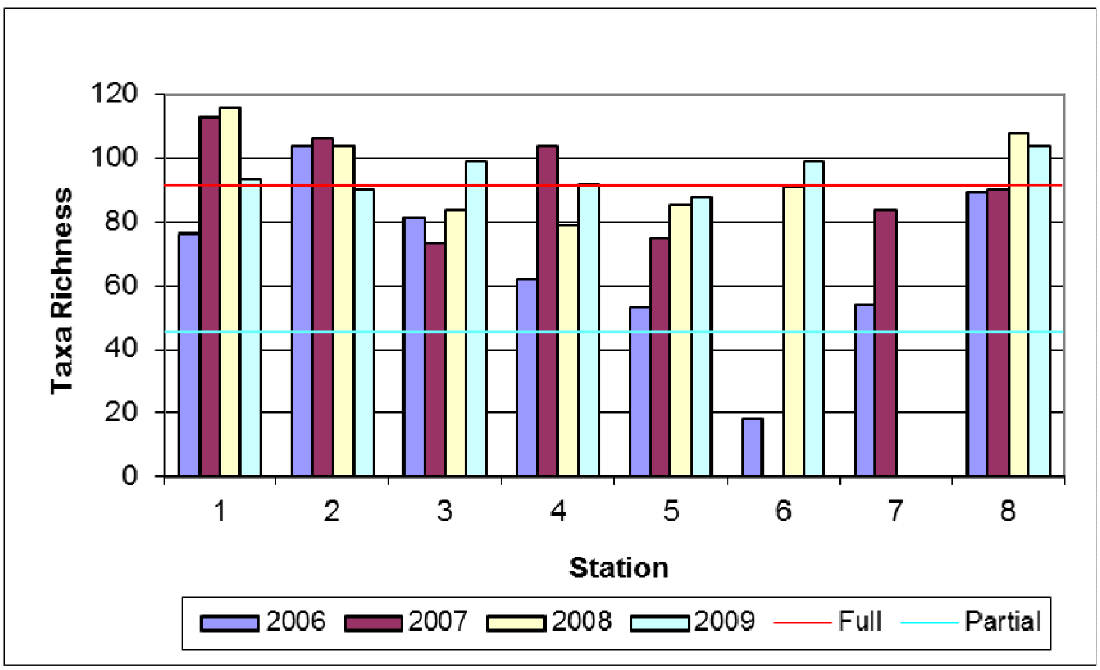
Figure 2
East Fork Black River Fall Macroinvertebrate Stream Condition Index Scores



Spring Taxa Richness Trends

Unlike previous years, in which Taxa Richness has tended to decrease in stations nearer the Lower Reservoir dam, the number of taxa among lower East Fork stations was similar (Figure 3). With the exception of 2006, Station 3 repeatedly has had the lowest Taxa Richness value of the three downstream stations, but in 2009 Station 3 actually had higher Taxa Richness than either of the other two lower river stations. Station 1 had the largest decrease in Taxa Richness of any site compared to the previous year, with 23 fewer taxa in 2009; however, Station 2 was the only lower river site that fell to a partially supporting score for that metric. For stations upstream of the Lower Reservoir, there has been considerable variability. Station 4 regained sufficient numbers of taxa to attain fully supporting metric status in 2009. The number of taxa present at Station 5 continues to increase but has yet to surpass the fully supporting threshold. In spring 2009 the Station 6 Taxa Richness metric scored fully supporting for the first time since the Upper Reservoir breach.

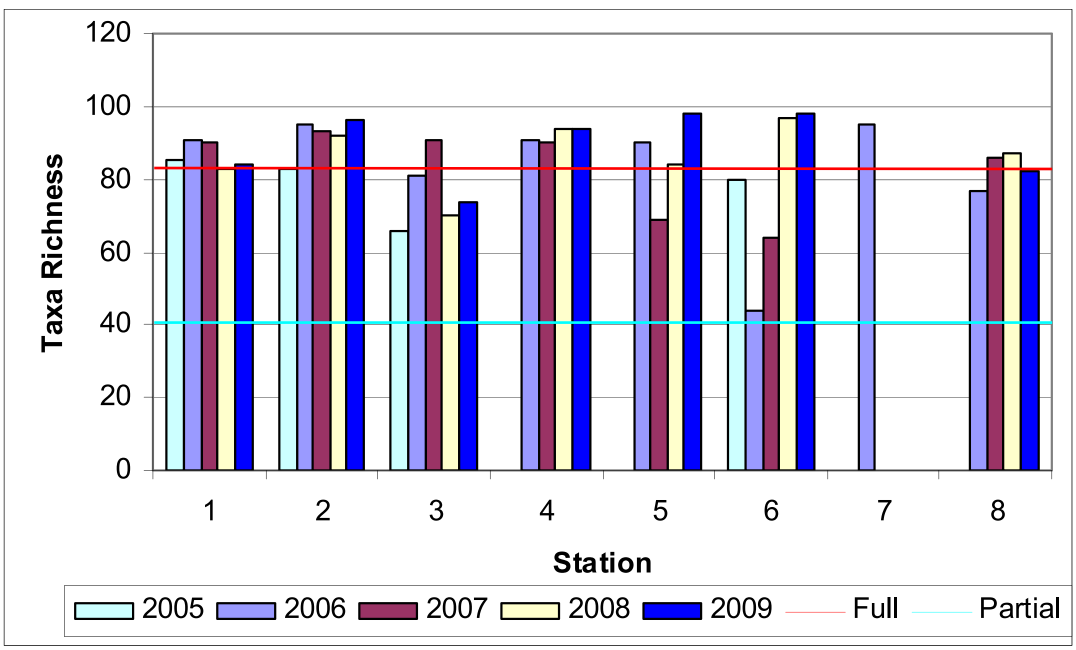
Figure 3
East Fork Black River Spring Taxa Richness Values



Fall Taxa Richness Trends

With a few exceptions, fall Taxa Richness values were comparable among East Fork Black River stations (Figure 4). For stations downstream of the Lower Reservoir, Station 3 exhibited a steady increase from 2005 to 2007 but decreased to near 2005 levels in 2008. Station 3 Taxa Richness increased in fall 2009 compared to 2008, but only slightly. Taxa Richness for Stations 1 and 2 tended to exhibit less variability among years compared to Station 3. Station 2 fall Taxa Richness has remained nearly unchanged between 2006 to 2009. Among stations upstream of the Lower Reservoir, fall 2008 Taxa Richness values all were at least somewhat higher than 2007, but this trend did not continue in 2009. Only Station 5 had a notable increase in Taxa Richness (14 more than in 2008). Stations 4 and 6 were the same or nearly the same among years, but Station 8 had a decrease of four taxa in 2009. Once again, Station 6 exceeded all previous Taxa Richness values for the site, including in years prior to the Upper Reservoir breach when it was a biological criteria reference reach.

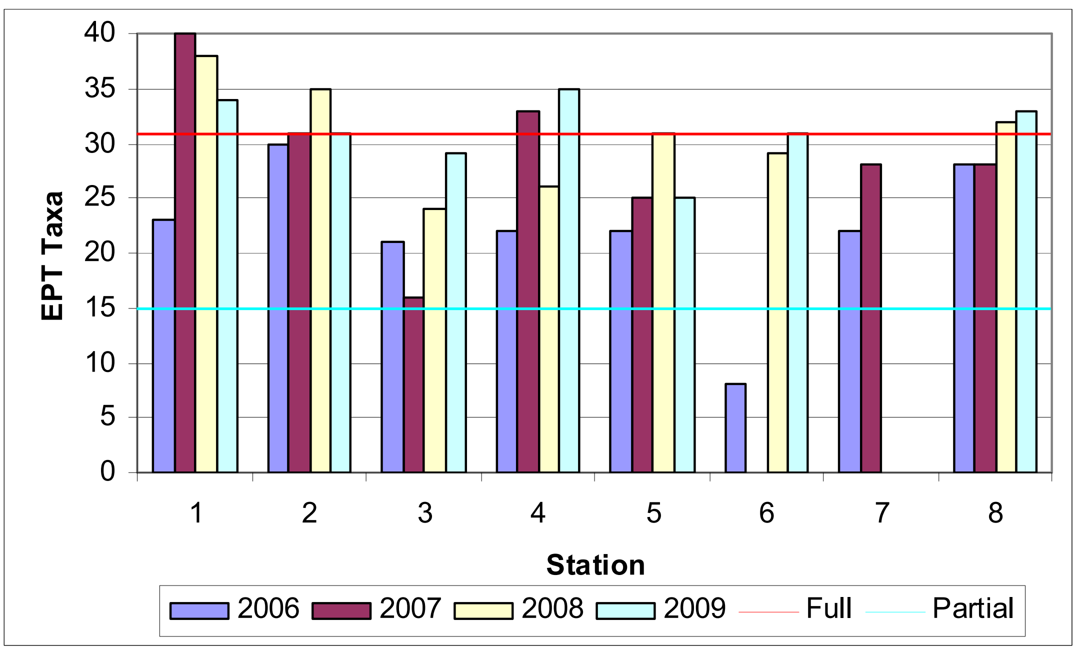
Figure 4
East Fork Black River Fall Taxa Richness Values



Spring EPT Taxa Trends

Patterns of spring EPT Taxa were more variable in 2008 compared to 2007 (Figure 5). Among stations downstream of the Lower Reservoir, Stations 1 and 2 each had a lower number of EPT taxa in 2009 than spring 2008. Station 1 had as many as 40 EPT Taxa in 2007, but this number has decreased incrementally during the past two spring sample seasons. Station 2 EPT Taxa numbers have been nearly identical among spring sample seasons, with the exception of 2008, for which this metric was higher. Station 3 had more EPT Taxa in spring 2009 than any of the previous years and, although the lowest among the downstream stations, was only slightly lower than Station 2. For stations upstream of the Lower Reservoir, Stations 4, 6, and 8 had higher numbers of EPT Taxa than any of the past spring samples. Station 5, which had a notable increase in EPT Taxa between 2007 and 2008, returned to 2007 levels in 2009. Station 6 had an equal number of EPT taxa in 2008 (N = 29) as spring 2000 when it was sampled as a biocriteria reference reach. A total of 31 EPT taxa were present in spring 2009, which is the threshold value to achieve the highest possible score for this metric.

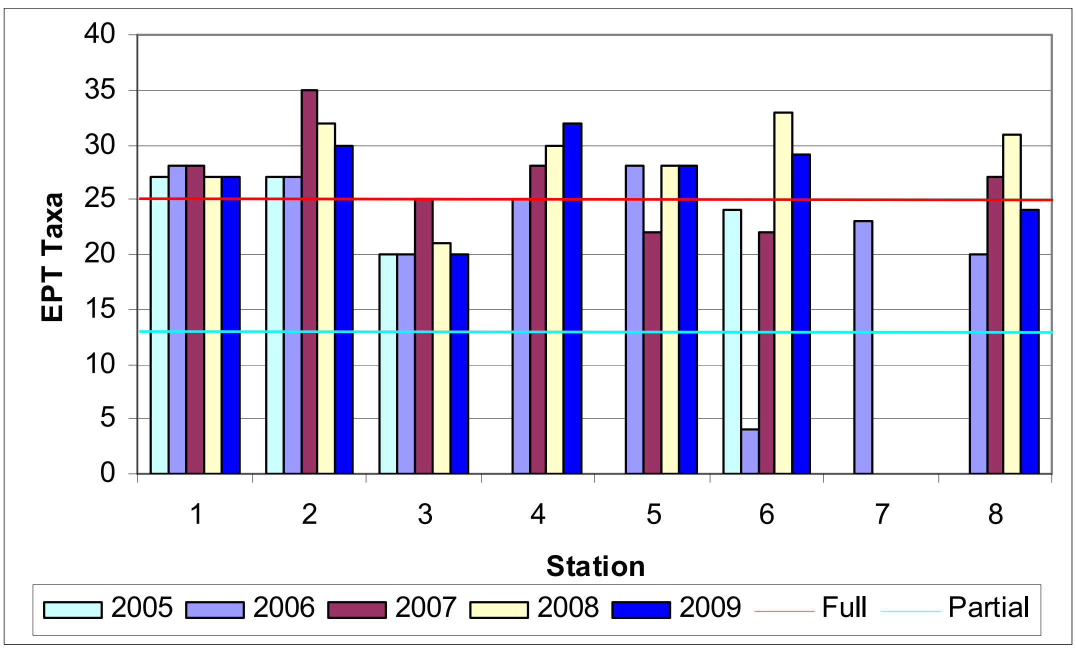
Figure 5
East Fork Black River Spring EPT Taxa Values



Fall EPT Taxa Trends

Among stations downstream of the Lower Reservoir, Station 2 and 3 EPT Taxa values have declined during the past three fall sample seasons (Figure 6). Station 1 fall EPT Taxa values have varied only by one taxon during the five years of this study. Station 3, which had its highest number of EPT Taxa in 2007, returned to levels identical to past samples in 2009. The upstream sites demonstrated more variability among stations. Station 4 continued its trend of EPT Taxa values increasing during every fall sample season since 2006. With the exception of 2007, Station 5 has had an identical number of EPT Taxa since sampling began in 2006. Station 6 and 8 EPT Taxa values peaked in 2008 and then had lower numbers in 2009. Station 8 EPT Taxa had declined sufficiently in 2009 to fall into the partially supporting range for this metric, the only site other than Station 3 to do so.

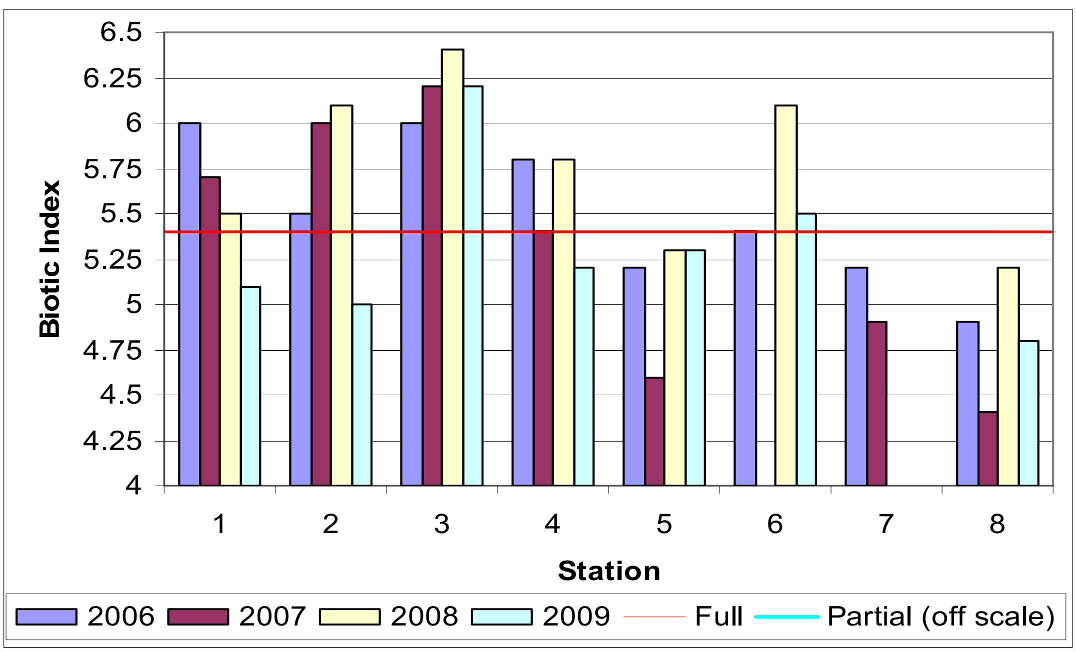
Figure 6
East Fork Black River Fall EPT Taxa Values



Spring Biotic Index Trends

With the exception of Station 5, the Biotic Index for each East Fork sample site was lower in spring 2009 than 2008 (Figure 7). Spring 2008 Biotic Index values tended to be higher compared to previous years among most stations, but in 2009 values for this metric either returned to comparable levels or were much lower than the past. Station 1 Biotic Index values have decreased each year between 2006 and 2009, whereas the remaining stations downstream of the Lower Reservoir had increased each year until the spring 2009 season. The Station 2 Biotic Index value was much lower in 2009 compared to previous years and was in the fully supporting range for this metric for the first time since the study began. The Biotic Index value for Station 3 decreased slightly between 2008 and 2009 and returned to the 2007 level. Even with this decrease, however, the Station 3 Biotic Index value was considerably higher than either of the other downstream stations. Spring 2009 Biotic Index values were lower than in 2008 at each of the stations upstream of the Lower Reservoir, with the exception that Station 5 had identical values in this time frame. Of the upper East Fork stations, only Station 6 did not have a Biotic Index value sufficient to achieve a score of 5.

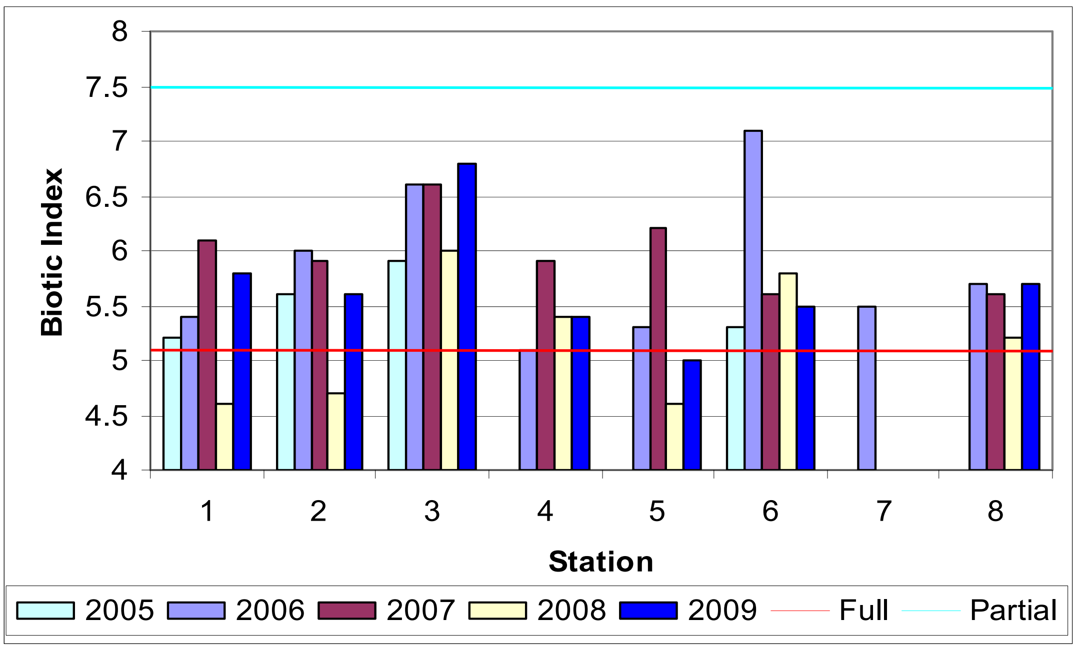
Figure 7
East Fork Black River Spring Biotic Index Values



Fall Biotic Index Trends

Fall 2009 Biotic Index values were higher than 2008 at each site except Station 6 (Figure 8). Whereas Stations 1, 2, and 5 had Biotic Index values that were sufficiently low (BI < 5.1) to attain the highest score of 5 for that metric in 2008, only Station 5 met this goal in 2009. The stations downstream of the Lower Reservoir had much larger increases between 2008 and 2009 than the upstream stations, and, in the case of Station 3, the Biotic Index value was higher than any of the previous years.

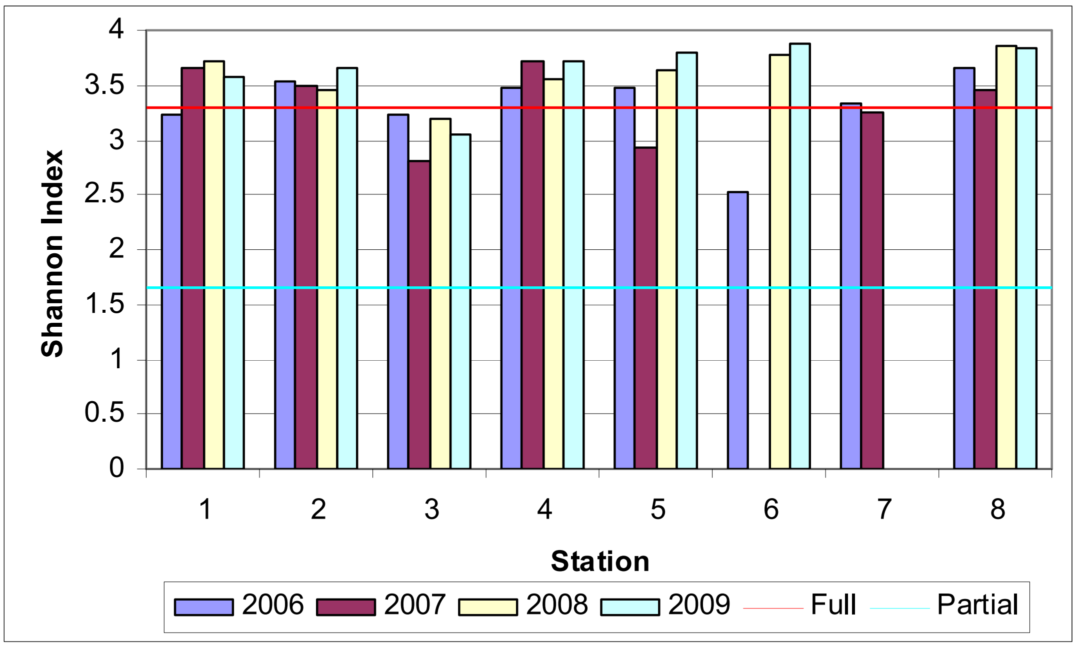
Figure 8
East Fork Black River Fall Biotic Index Values



Spring Shannon Diversity Trends

As was the case in 2008, all sites except Station 3 had spring 2009 SDI values sufficient to achieve a fully supporting score of 5 for that metric (Figure 9). Station 3 spring SDI values for all four years have been below the threshold required to reach a score of 5. The remaining downsteam stations had SDI values that were similar to one another. Among stations upstream of the Lower Reservoir, SDI values also were similar to one another, Station 6 having slightly higher values than the remaining stations.

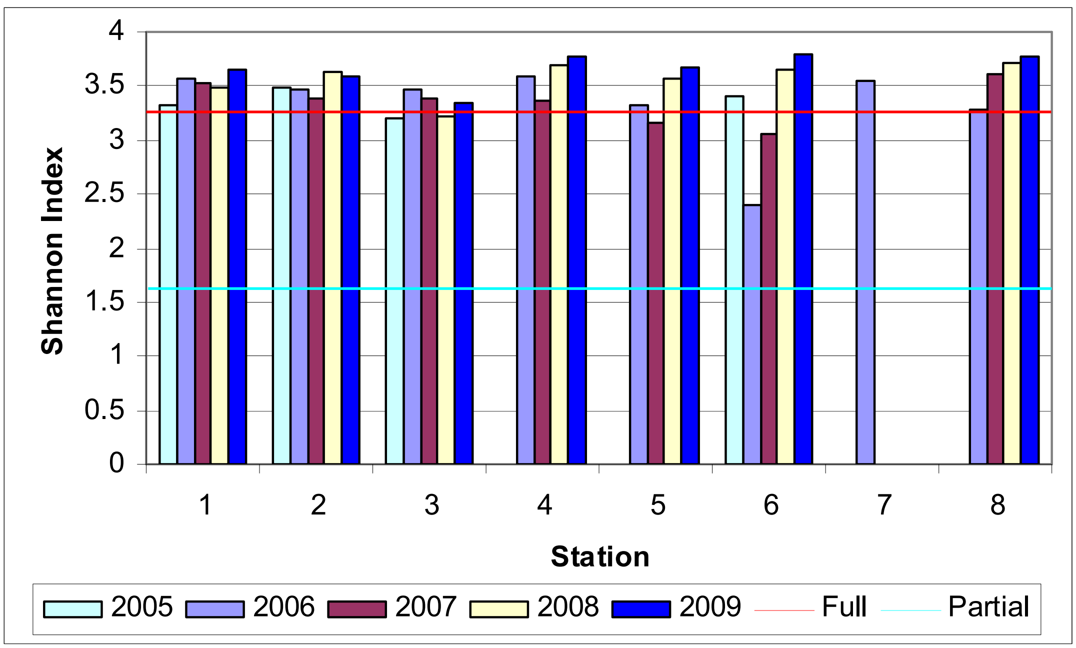
Figure 9
East Fork Black River Spring Shannon Diversity Index Values



Fall Shannon Diversity Trends

Fall Shannon Diversity Index values were fairly consistent among stations and among years (Figure 10). Fall 2008 SDI values were higher at each of the East Fork sites than any of the previous years, except Stations 2 and 3. Station 2 had an SDI that was only slightly lower in 2009 than 2008. The Station 3 fall 2009 SDI value was slightly higher than 2008 but was sufficient to attain a fully supporting score of 5 for the metric. Shannon Diversity Index values tended to be higher among the upstream stations, Station 6 having the highest value in 2009 compared to any recorded previously in this entire study reach.

Figure 10
East Fork Black River Fall Shannon Diversity Index Values



6.2.2 Macroinvertebrate Community Composition Trends

In previous East Fork Black River biological assessment reports (Michaelson 2007, 2009, 2010), the macroinvertebrate community composition of fall 2005 was compared to the post-event fall community among stations downstream of the Lower Taum Sauk Reservoir dam. In the initial post-event comparison using 2006 data (Michaelson 2007), the report states that the "macroinvertebrate community composition was similar among fall samples at Stations 1 and 2. Exceptions were that the family Chironomidae was represented by more taxa and, in some habitats, more individuals." The 2007 report also states that Station 3 exhibited more differences in the post-event fall 2006 macroinvertebrate community composition than the remaining downstream stations when compared to fall 2005. These differences include:

- more diversity and abundance within the family Chironomidae;
- increased mayfly taxa richness in coarse substrate habitat;
- a dramatic decline of mayfly abundance in rootmat habitat;
- a decline of mayfly taxa richness and abundance in nonflow habitat;
- a decreased number of caddisfly individuals in coarse substrate habitat with an unchanged caddisfly taxa richness; and
- a decrease in the number of caddisfly taxa and abundance in rootmat habitat.

Several trends noted in the preceding paragraph also were observed in 2008 samples; other trends, however, were not. A station-by-station comparison of the fall 2005 versus fall 2009 macroinvertebrate community composition will be presented in later paragraphs and in Tables 20 and 21. In addition, pre-event data from the former Biological Criteria Reference reach (2005 Station 4) will be compared to the restored East Fork reach of Station 6. First, however, the trends noted above for Station 3 will be addressed in a similar format for comparing 2005 with 2009 data:

- fall 2009 chironomid taxa richness and abundance were greater than fall 2005;
- fall 2009 mayfly taxa richness in coarse substrate habitat was less than 2005;
- Station 3 mayfly abundance in rootmat habitat was lower in 2009;
- mayfly abundance in Station 3 nonflow habitat was lower in 2009, but mayfly taxa richness was greater;
- caddisflies were nearly absent from coarse substrate in 2009, but there were an equal number of taxa compared to 2005;
- Station 3 rootmat had lower caddisfly abundance but equal taxa richness in 2009 compared to 2005.

<u>East Fork Black River Station 1</u>

Station 1 had one additional mayfly taxon in fall 2009 (N=19 taxa) than fall 2005, but lower numbers of individuals were observed. Whereas the number of mayflies present in nonflow was similar between years, they were less abundant in coarse substrate and much less abundant in the rootmat habitat. With all three habitats combined, the total number of mayflies in the 2009 sample was only 61 percent that of the fall 2005 sample. Because of these lower numbers of individuals, mayflies accounted for a lower percentage of the

total sample in 2009 (36.0 percent) than 2005 (48.1 percent). Stoneflies were rare in both sample years and were found only in the coarse substrate sample. Whereas the fall 2005 sample had two stonefly taxa, the 2009 sample had only one. Caddisflies were present in much lower abundance in the coarse substrate habitat in 2009, but compared to 2005 caddisflies were six times more abundant in the rootmat sample. Overall, despite having lower caddisfly abundance in 2009, there was one additional taxon than in 2005. Despite the lower abundance in 2009, caddisflies made up similar percentages of both sets of fall samples. In addition to having a greater number of individuals, the fall 2009 sample had 12 more chironomid taxa than 2005. In addition, chironomids made up nearly triple the sample in 2009 (10.8 percent in 2005 versus 27.6 percent in 2009). Aquatic worms (including the families Tubificidae, Lumbriculidae, and order Lumbricina) were present in nearly equal abundance in both fall samples. The fall 2009 sample had a single additional aquatic worm taxon compared to 2005. Only one molluscan taxon, the exotic Asian clam (*Corbicula* sp.), was found in the fall 2009 sample, compared to four taxa collected in 2005. More Asian clams were collected in 2009 than all four mollusk taxa combined in 2005. Beetles (Coleoptera) were considerably lower in abundance in the 2009 coarse substrate sample compared to 2005 but roughly similar in the remaining habitats. The total number of beetles in 2008 for all three habitats combined was roughly half of the 2005 sample, but with only two fewer taxa.

<u>East Fork Black River Station 2</u>
Station 2 mayfly abundance and taxa richness were similar between the two years (18 mayfly taxa in 2009 and 17 in 2005). Mayflies also accounted for similar percentages of the two fall samples (36.3 percent in 2009 and 39.1 percent of the 2005 sample). Mayflies were slightly more abundant in the 2009 coarse substrate sample, but were much less abundant in the remaining habitats compared to 2005. Stoneflies also were present in similarly low numbers in Station 2 fall samples for both years. In 2005 12 stoneflies of two taxa made up 0.9 percent of the sample; in 2009 9 stoneflies of three taxa made up 0.7 percent. Caddisflies were much less abundant in 2009 coarse substrate habitat, but the rootmat habitat had more individuals. Including all three habitats, however, the 2009 sample had less than half the number of caddisflies compared to 2005 and made up a lower percentage of the overall sample (4.1 percent in 2009 versus 8.8 percent in 2005). Although the number of caddisfly individuals was much lower, taxa richness for this group was slightly higher in 2009 (nine caddisfly taxa in 2009 and seven in 2005). Chironomid abundance was much lower in the 2009 coarse substrate habitat but was considerably higher in the rootmat. When combining the three habitats, the number of chironomid individuals was quite similar between the two sets of samples, but there were nine more taxa in 2009 than in 2005. Chironomids represented a similar percentage of both fall samples (17.3 in 2009 and 16.8 percent in 2005). Aquatic worms were less abundant in all three 2009 habitats, but the number of taxa was equal to the 2005 total. Mollusks were more abundant in each 2009 habitat sample compared to 2005, but the number of molluscan taxa was equal between years.

East Fork Black River Station 3

With all three habitats combined, mayflies were present in similar numbers but made up a lower percentage of the overall sample in 2009 (26.5 percent) compared to 2005 (30.4 percent). In addition, the number of mayfly taxa present in 2008 was nearly equal to 2005. When comparing by habitat, however, there were differences. Mayfly abundance was lower in the 2005 coarse substrate sample, but there were two fewer taxa for this habitat in 2009. Although the nonflow habitat mayfly abundance was lower in 2009, there were four more taxa compared to 2005. For the rootmat habitat, there were equal numbers of mayfly taxa between years, despite lower abundance in 2009. In 2005 a total of 16 stoneflies of one taxon were found in the coarse substrate sample; the remaining habitats had no stoneflies. No stoneflies were present in the 2009 Station 3 sample. In 2009 caddisflies were much less abundant than 2005, particularly in coarse substrate where only six individuals were found in 2009. Overall, the 2009 sample had approximately one quarter of the number of caddisflies compared to 2005, and caddisflies made up a lower percentage in 2009 (3.9 percent) than 2005 (17.1 percent). Despite this lower abundance, the number of caddisfly taxa was equal between years. Chironomid abundance and taxa richness was much higher in the 2009 coarse substrate habitat. Although the remaining habitats had similar chironomid abundance, fewer taxa in this family were present in the 2009 nonflow sample, and the rootmat sample had identical chironomid taxa richness compared to 2005. Chironomids made up a much larger percentage of the overall sample in 2009 (45.8 percent) compared to 2005 (26.3 percent). Each habitat had the same number of aquatic worms or fewer in 2009 than in 2005. Aquatic worms were found in low abundance in all but the rootmat habitat, where they were absent in 2009. The number of mollusks found in 2009 was greater than 2005 but with only one additional taxon. The greatest increase in molluscan abundance between 2005 and 2009 occurred in the rootmat sample, which increased by a factor of 10. Beetles were much less abundant in the 2009 coarse substrate and nonflow habitat samples. In 2005, 45 individuals of a single taxon (*Stenelmis*) were present in the nonflow habitat, but in 2009 only five individuals (of the genera *Stenelmis* and *Dubiraphia*) were collected in this habitat. In the 2005 coarse substrate sample, 120 individuals of four beetle taxa were present. By comparison, only 19 individuals of four taxa were present in the 2009 sample. Only a single beetle was found in the rootmat sample in 2005, but none were found in 2009.

East Fork Black River Station 6 (Station 4 during the 2005 sample season)

Mayflies were slightly less abundant in 2009 than 2005. Despite the presence of fewer mayfly individuals, the 2009 sample had two more taxa than 2005. Mayflies made up a smaller percentage of the 2009 sample (40.6 percent in 2005, 28.6 percent in 2009). Whereas the nonflow and rootmat habitats had similar mayfly abundance between years, there were fewer mayflies present in the coarse substrate portion of the 2009 sample. There were, however, more taxa in the 2009 coarse substrate and nonflow habitats compared to 2005. Stoneflies were rare in both fall samples, with only three individuals of two taxa occurring in 2005 and 10 individuals of three taxa in 2009. Caddisflies were slightly more abundant in 2009 and made up a larger percentage of the overall sample

(12.8 percent in 2005, 16.1 percent in 2009). There were two more caddisfly taxa present in the 2009 sample compared to 2005, but caddisflies were found only in the coarse substrate and rootmat habitats in 2009. Unlike the 2008 sample, in which caddisfly taxa richness was equal among habitats, they were absent from the nonflow portion of the 2009 sample. Beetles were more abundant in the 2009 sample, but increases were observed only in nonflow and rootmat habitats. Compared to 2005, the 2009 sample had one additional beetle taxon present. Chironomids were more abundant and had greater taxa richness in 2009 compared to 2005. The greatest increase observed in both chironomid abundance and taxa richness occurred in the nonflow portion of the 2009 sample. Whereas the 2005 nonflow sample had 110 individals of 9 taxa, the 2009 nonflow had 210 individuals of 24 taxa. Aquatic worms were slightly more abundant in 2009 compared to 2005 but with one fewer taxon. Mollusks were present in equal numbers for both years (N=8), with one more taxon occurring in the 2009 sample.

Table 20
Lower East Fork Black River Taxa Comparison: 2005 Pre-Event versus 2009 Post-Event*
Number of Individuals (Number of Taxa in Parentheses)

	Station 1								Station 2								Station 3							
	Fall 2005				Fall 2009				Fall 2005				Fall 2009				Fall 2005				Fall 2009			
	CS	NF	RM	Total	CS	NF	RM	Total	CS	NF	RM	Total	CS	NF	RM	Total	CS	NF	RM	Total	CS	NF	RM	Total
Ephem	383(14)	125(10)	214(9)	722(18)	237(13)	117(9)	93(6)	447(19)	239(13)	140(6)	134(5)	513(17)	343(12)	33(8)	67(3)	443(18)	123(9)	159(6)	113(4)	395(12)	175(7)	112(10)	72(4)	359(13)
Odonata	21(3)	10(3)	18(4)	49(7)	24(2)	17(4)	24(5)	65(7)	19(2)	5(4)	26(3)	53(5)	14(1)	3(2)	34(3)	51(5)	7(1)	5(1)	25(4)	37(4)	4(3)	27(3)	26(3)	57(5)
Plecop	7(2)	--	--	7(2)	4(1)	--	--	4(1)	12(2)	--	--	12(2)	4(2)	5(2)	--	9(3)	16(1)	--	--	16(1)	--	--	--	--
Trichop	78(3)	--	5(3)	83(6)	20(3)	3(3)	30(5)	53(7)	104(5)	8(4)	4(2)	116(7)	19(5)	4(2)	28(4)	51(9)	188(2)	5(3)	29(5)	222(7)	6(2)	38(3)	10(5)	54(7)
Coleop	256(5)	37(4)	53(5)	346(8)	90(4)	26(5)	45(4)	161(6)	111(4)	81(4)	30(5)	222(7)	107(4)	66(5)	33(5)	206(7)	120(4)	45(1)	1(1)	166(4)	19(4)	5(2)	--	24(4)
Chiro	56(10)	45(10)	61(14)	162(20)	118(17)	106(19)	119(18)	343(32)	124(9)	75(12)	22(10)	221(23)	51(20)	76(17)	85(13)	212(32)	78(9)	116(13)	147(11)	341(22)	365(25)	130(19)	125(11)	620(28)
Worms†	8(2)	10(1)	1(1)	19(2)	9(2)	8(3)	--	17(3)	12(2)	11(3)	1(1)	24(4)	2(2)	5(3)	--	7(4)	2(2)	8(3)	3(1)	13(4)	7(3)	2(3)	--	9(3)
Mollusca	15(3)	14(2)	5(2)	34(4)	13(1)	37(1)	--	50(1)	6(2)	8(2)	17(3)	31(6)	24(3)	44(4)	33(5)	101(6)	11(2)	16(2)	3(1)	30(2)	12(2)	7(1)	30(2)	49(3)

*excludes Hemiptera, Megaloptera, Lepidoptera, and "Other Diptera"; †"Aquatic worms" includes Tubificidae, Lumbriculidae, and Lumbricina

Table 21
East Fork Black River Station 4/Station 6 Taxa Comparison: 2005 Pre-Event versus 2009 Post-Event*
Number of Individuals (Number of Taxa in Parentheses)

	Fall 2005 (Station 4)				Fall 2009 (Station 6)			
	CS	NF	RM	Total	CS	NF	RM	Total
Ephem.	346(13)	113(4)	34(8)	493(17)	244(15)	116(9)	28(6)	388(19)
Odonata	21(2)	6(2)	31(6)	58(7)	12(1)	4(3)	64(3)	80(5)
Plecop.	3(2)	--	--	3(2)	9(3)	1(1)	--	10(3)
Trichop.	118(5)	2(1)	36(4)	156(5)	181(5)	--	37(5)	218(7)
Coleop.	55(4)	9(3)	15(6)	79(8)	58(3)	38(8)	23(3)	119(9)
Chiro.	66(10)	110(9)	48(14)	224(20)	65 (12)	210(24)	39(13)	314(32)
Worms†	4(2)	9(3)	1(1)	14(4)	9(1)	12(3)	--	21(3)
Mollusca	0(1 Large/Rare)	1(1)	7(4)	8(4)	2(1)	2(2)	4(3)	8(5)

*excludes Hemiptera, Megaloptera, Lepidoptera, and "Other Diptera"; †"Aquatic worms" includes Tubificidae, Lumbriculidae, and Lumbricina

6.2.3 Macroinvertebrate Quantitative Similarity Index

The Quantitative Similarity Index (**QSI**) compares two aquatic communities in terms of presence or absence of taxa, also taking relative abundance (percent composition) of each taxon into account (MDNR 2010g). QSI values range from 0 to 100 percent. Identical communities have a QSI of 100 percent, whereas totally different communities have a value of 0 percent. Although the QSI can be used for several applications where a comparison of overall macroinvertebrate community composition is required, pre-event data from each of the four EFBR samples collected in fall 2005 will be compared to post-event sample data to determine the degree to which the macroinvertebrate community has changed. To provide some perspective, a QSI rating of 70 percent is considered the minimum standard in the SMSBPP when conducting side-by-side duplicative sampling for quality assurance purposes, although other states' biological monitoring programs have an acceptable range of 60 to 85 percent (MDNR 2010g).

Compared to fall 2005, the QSI increased from fall 2006 to fall 2007 for all stations but then decreased sharply in fall 2008 (Table 22). The Station 1 QSI value was higher in 2009 than 2008 but was still lower than the highest value observed in 2006. The 2009 QSI value for Station 4/6, the restored reach within JSISP, was the highest observed since the Upper Reservoir failure. Stations 2 and 3, however, each had the lowest QSI values in 2009 of any of the previous years.

Table 22
East Fork Black River Quantitative Similarity Index,
Fall 2005 Data Compared to Post-Event Fall Data

Station	Fall 2006	Fall 2007	Fall 2008	Fall 2009
1	63.9	68.3	50.0	57.7
2	56.2	67.4	52.0	51.3
3	44.0	52.9	44.6	40.6
4(6)	12.3	55.7	43.8	60.2

7.0 Discussion

7.1 Water Quality

Few differences existed among water quality parameters throughout the study reach, even when comparing stations upstream versus downstream of Lower Taum Sauk Reservoir. Among nutrient parameters, only total nitrogen consistently was present in concentrations that exceeded laboratory detectable or PQLs in spring 2009. By contrast total nitrogen, as well as the majority of tested nutrients, was below the PQL or detection limits during the fall.

One remarkable observation was with regard to turbidity. Water quality samples were collected from Station 3 on March 24 at a flow of 31 cfs; on March 25 samples were collected from Station 1 at a flow of 360 cfs. Although the sampling that occurred on March 25, 2009 following the thunderstorm did not capture the "first flush," which is valuable in stormwater analysis, it is worth noting that turbidity readings of Station 1 and

Station 3 were nearly identical (a difference of 0.07 NTU) despite a 10-fold increase in flow. Over the course of several days after the thunderstorm, turbidity did increase in the lower river, presumably due to suspension of sediments in the Lower Reservoir. The increase in turbidity, however, was slight (5 to 9.6 NTU) when taking into account the amount flow rates increased. Because of event-related sediment remaining in the Lower Reservoir, however, the presence of a gaging station in the lower river will prove useful to observe turbidity responses under a variety of river flows and Lower Reservoir volumes.

7.2 Biological Assessment

7.2.1 East Fork Black River Downstream of Lower Taum Sauk Reservoir

Among stations downstream of the Lower Reservoir, MSCI scores tended to be lower as stations approached the dam in spring 2009, but individual metrics were variable. Station 3, for example, had the highest Taxa Richness value of any of the downstream stations, but each of the remaining biological metrics had partially supporting scores. Each of the three metrics for which Station 3 had partially supporting scores--EPT Taxa, Biotic Index, and Shannon Diversity Index--suggest that the overall macroinvertebrate community at this site is made up of more tolerant individuals with fewer sensitive taxa present.

In fall 2009 both Stations 1 and 2 attained fully supporting MSCI scores of 18, but Station 3 once again had a partially supporting score of 14. The fall partially supporting score for Station 3 was due to lower scores in a slightly different suite of biological metrics. Taxa Richness, EPT Taxa, and Biotic Index values all were in the partially supporting range. Of particular note was that Station 3 had 25 fewer total taxa in fall than spring. By comparison, Station 1 had nine fewer taxa, but Station 2 had in increase of six taxa. Although the Station 3 Shannon Diversity Index was sufficiently high to attain a fully supporting individual metric score, the remaining metric scores were partially supporting.

Past East Fork Black River bioassessments have brought up several factors that may contribute to the consistent Station 3 macroinvertebrate community impairment. These factors include dissolved oxygen concentration, adequate flow, and benthic substrate habitat suitability (Michaelson 2010). Missouri Department of Conservation **(MDC)** dataloggers in the Station 3 sample reach indicated no instances of low dissolved oxygen in the months prior to fall 2008 sampling. During the summer months before fall 2009 sampling, however the USGS gaging station located downstream of the Lower Taum Sauk Reservoir (gage #07061290) showed several occasions in which dissolved oxygen concentrations in the Station 3 sample reach were below the 5 mg/L minimum concentration listed in Missouri's Water Quality Standards. The lowest recorded concentration of 1.9 mg/L occurred on August 27, 2009; however there were a total of 15 days between July 28 and August 30, 2009 in which dissolved oxygen concentrations were between 2.0 mg/L and 4.9 mg/L.

Lack of consistent, adequate flow also may have been a factor contributing to low fall 2009 macroinvertebrate metric scores but likely played a lesser role compared to previous years. Based on gaging station data, flow tended to be relatively robust during most of summer 2009, but there was one three-day period at the end of August 2009 in which the average daily discharge recorded at Station 3 was <1.0 cfs. Compared with 2008 flow data collected at the Highway 21 USGS gage (#07061300) located approximately 3.8 miles downstream of the Lower Reservoir, flow during summer 2009 was higher and more stable. Whereas the average daily flow rates dropped below 1.0 cfs 16 times during the summer months of 2008, flow rates rarely fell below 5.0 cfs in 2009.

As discussed in a previous bioassessment (Michaelson 2010), size fractions of Station 3 benthic substrate tend to be skewed toward cobble sized substrate (2.5 - 10.1 inches) and away from the small and large gravel (0.079 - 2.5 inches) size fractions. Biological effects resulting from this lack of substrate heterogeneity are presently being studied by MDC personnel. It is likely that these effects will continue as long as there are structures upstream of this reach preventing the recruitment of varying size classes of fresh gravel from upstream.

7.2.2 East Fork Black River Upstream of Lower Taum Sauk Reservoir

All four stations upstream of the Lower Reservoir achieved fully supporting scores during both 2009 sample seasons, with the exception that Station 8 had a partially supporting score in fall 2009. The Station 8 partially supporting fall MSCI score was due to lower Taxa Richness and EPT Taxa scores compared to the remaining upstream stations. Station 8 has exhibited some biologial metric variability in the past, particularly Taxa Richness and EPT Taxa. Although this uppermost station is smaller than many of the downtream sites and its biological community has responded to extremely dry conditions in the past (e.g. fall 2006), this is not a likely explanation for the fall 2009 score. The USGS gage at Highway N (gage #07061270), which is a short distance downstream of Station 8, recorded adequate flows during summer 2009 when compared to previous years when MSCI scores at this station were higher despite lower flows.

7.3 Macroinvertebrate Community Composition

Several stations had failed to reach habitat-specific target numbers in spring 2009; however, all but Station 3 had fully supporting MSCI scores. In fall 2009 only two sites (Stations 4 and 8) each had one habitat that did not reach its target number. In the case of Station 4, however, this low number was due to a laboratory processing discrepancy. Of the two sites that did not reach target numbers for all three habitats, only Station 8 did not attain a fully supporting MSCI score. Station 4 had fully supporting scores for each biological metric except Biotic Index and had an MSCI score of 18.

Macroinvertebrate community composition patterns observed in spring 2009 included a higher abundance of mayflies at Stations 1 and 2 compared to all other upstream stations. Among mayflies, the family Baetidae was more abundant in stations upstream of the Lower Reservoir, but no other distinct patterns were observed with respect to other mayfly families and their location relative to the reservoir in spring. Stoneflies were

similar both in abundance and taxa richness among stations except that Station 3 had the lowest number of stoneflies. Stonefly taxa richness at Station 3, however, was similar to the remaining stations. Station 3 had the highest abundance of caddisflies of any of the East Fork sample sites, but they were heavily skewed toward one genus (*Cheumatopsyche*). Although *Cheumatopsyche* was the dominant caddisfly genus at all but Stations 1 and 2, they were particularly abundant at Station 3. With respect to caddisflies, one trend was observed during both seasons: the genus *Helicopsyche* was represented by at least a few individuals at each site except Station 3. The absence of this genus is noteworthy because of its extremely sensitive nature. *Helicopsyche* has a biotic index value of 0, whereas *Cheumatopsyche* (the Station 3 dominant caddisfly taxon) has a biotic index value of 6.6. A biotic index value of 6.6 is in the moderately tolerant range with respect to organic pollutants. Chironomids, another taxa group that is generally considered moderately tolerant, were more abundant and diverse at Station 3 than any of the remaining sites.

In fall 2009 samples, the number of mayfly taxa was fairly similar among stations, with the exception that Station 3 had fewer than the others. As was the case in spring, the mayfly family Baetidae was more abundant among stations upstream of the Lower Reservoir and was represented by more taxa at nearly all of the upstream stations. By contrast, Caenidae and Leptohyphidae were more numerous in downstream stations, but each of these families was represented by the same number of taxa. No clear distinction was evident in the biotic index values of dominant mayfly groups relative to station location. Baetidae, which was more abundant among upstream stations, has a biotic index value of 4.0. Caenidae, which was more abundant in downstream stations, has a biotic index value of 7.0. However, Leptohyphidae, which was also more abundant among downstream stations, has a biotic index value of 4.0. Caddisflies tended to be more abundant in samples collected upstream of the Lower Reservoir in fall 2009. As mentioned earlier, the pollution sensitive caddisfly genus *Helicopsyche* was represented by at least a few individuals at all stations except Station 3. Unlike spring, however, *Helicopsyche* tended to be more abundant in upstream stations, particularly Stations 4, 5, and 6, where they accounted for as much as half of all caddisflies. As was the case in spring, *Cheumatopsyche* was by far the dominant caddisfly at Station 3 during the fall sample season. *Cheumatopsyche* was approximately 10 times more abundant at Station 3 compared to the remaining downstream stations. Riffle beetles tended to be less abundant and less diverse at Station 3 compared to all other East Fork sample sites. Whether the relatively low numbers of riffle beetles at Station 3 is related to the benthic substrate size diversity issue discussed earlier may be a consideration.

7.4 Data Trends

7.4.1 Water Quality

Although turbidity has been a major water quality consideration since the Upper Reservoir breach in 2005, it appears to have become less of a factor. Turbidity was lower in spring 2009 than any year since spring sampling began in 2006. Also of note was that turbidity readings were similar between stations located upstream of the Lower Reservoir compared to the lower East Fork stations. The thunderstorm that occurred during spring

sampling provided an important insight into turbidity trends for the system. Stations 2 and 3 were sampled prior to the storm when discharge was roughly 30 cfs and Station 1 was sampled the following day when discharge was at 360 cfs. Although sampling was not conducted during the "first flush" of the storm event, it seems significant that turbidity in the lower river was nearly equal despite the fact that flow rates increased by a factor of 10. Whatever event-related sediment that may remain in the Lower Reservoir seems not to affect turbidity in the lower river, at least at the discharge rates observed.

Based on USGS gaging station data, dissolved oxygen concentrations downstream of the Lower Reservoir occasionally violate Missouri's water quality standards. Surface temperature during August 2009, when these sub-standard readings were observed, was moderate for this time of year and likely not a factor affecting dissolved oxygen. More probable factors include lower discharge rates during this time frame compared to weeks prior to and after the last week of August and the elevation(s) at which water was drawn from the Lower Reservoir to supply the lower East Fork. Other water quality parameters, particularly nutrient concentrations, have been roughly similar among years.

7.4.2 Biological Assessment

Most East Fork Black River stations sampled during 2009 had similar MSCI scores compared to previous years. With the exception of Station 8, each of the stations upstream of the Lower Reservoir had identical 2008 and 2009 fall MSCI scores. Station 8 changed from a fully to partially supporting MSCI score in fall 2009. This station also had a partially supporting MSCI score in 2006, but that sample was likely affected by drought conditions during the summer preceding fall sampling. According to USGS gaging station data collected just downstream from Station 8, however, average daily flow rates appeared to be adequate during the summer of 2009. It is unknown what factors may have contributed to the lower fall 2009 MSCI score. Other noteworthy MSCI scores include the spring 2009 Station 6, which was the first fully supporting spring sample recorded from the restored East Fork reach. Also, Station 3 had a higher fall 2009 MSCI score than the previous year, and the spring 2009 MSCI score was the highest of any spring sample collected from this site thus far. Despite these improvements, Station 3 continues to have partially supporting MSCI scores. Both Stations 1 and 2 maintained fully supporing MSCI scores despite notable declines in spring Taxa Richness and EPT Taxa compared to previous years. In fact, Station 1 achieved its first MSCI score of 20 in spring 2009. According to USGS gaging station data, neither discharge nor dissolved oxygen were noteworthy during the months prior to spring sampling. As was the case with the Station 8 fall scores, the reasons for the changes observed in these biological metrics are unknown.

Based on the biological metrics measured for these studies, the macroinvertebrate community of the restored East Fork Black River channel in JSISP (Station 6) continues to approach a status similar to pre-event conditions. Prior to the Upper Reservoir breach, this reach was among the biological criteria reference streams for the Ozark/Black/Current EDU. Spring 2009 Taxa Richness was slightly higher than both the spring sample collected in 1999 or 2000, and the number of EPT taxa was between that

of the two reference samples. The number of taxa collected in fall 2009 was well above any of the three collected between 1999 and 2005, and the number of EPT taxa approached the highest of these samples. Presently, this reach of stream has a good diversity of gravel sizes making up the benthic substrate, and the riparian corridor along this reach continues to mature. Along the sample reach, many of the trees planted along the river banks have grown sufficiently to extend considerable amounts of good quality fibrous rootmat into the water for invertebrate colonization.

7.4.3 Macroinvertebrate Quantitative Similarity Index

The QSI, in which fall 2005 macroinvertebrate samples were compared with those collected after the Upper Reservoir breach, was variable among stations in 2009. In 2007 the QSI was higher than 2006 at all stations but then declined in 2008. Although the QSI for Station 1 increased in 2009 compared to 2008, it was still not as high as the 2007 value. The QSI for Station 6 was the highest thus far, but both Stations 2 and 3 decreased in 2009 and had lower QSI values than any of the previous years. To reiterate from the previous annual report (Michaelson 2010), sufficient differences occur among years in Taxa Richess, EPT Taxa, and other taxa (e.g. chironomid abundance and taxa composition can change considerably from year to year at a given site) that QSI can vary, and these relatively low numbers (QSI<75) are not necessarily indicative of impairment.

8.0 Summary

1. Turbidity in the lower East Fork was similar among stations, despite one of the three samples being collected following a severe thunderstorm and resultant 10-fold increase in flow.

2. Of the nutrient parameters measured, only total nitrogen occurred in detectable concentrations at all stations.

3. Taxa Richness and EPT Taxa biological metrics were lower at Stations 1 and 2 in spring 2009 compared to previous years, but both stations maintained fully supporting MSCI scores.

4. Among stations downstream of the Lower Reservoir, Station 3 (nearest the dam) continues to have lower biological metric and MSCI scores than the others.

5. Only Station 3 had partially supporting scores during both sample seasons.

6. Of stations located upstream of the Lower Reservoir, only one MSCI score (Station 8) was partially supporting in either 2009 sample season.

7. The restored East Fork Black River reach within JSISP (Station 6) attained its first fully supporting spring MSCI score since the new channel was opened in April 2007.

8. For both 2009 seasons, Station 6 Taxa Richness and EPT Taxa were similar to or higher than values observed when this site was a Biological Criteria Reference stream.

9.0 Recommendations

1. Continue monitoring the East Fork Black River within JSISP to document whether macroinvertebrate community metrics of the restored reach continue to exceed pre-event levels.

2. Continue macroinvertebrate sampling in the EFBR downstream of the Lower Taum Sauk Reservoir, making note of discharge rates and dissolved oxygen concentrations during summer low flow conditions. These observations may aid in determining whether water quality is a factor contributing to consistently low Station 3 MSCI scores.

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Submitted by: ____

David L. Michaelson
Environmental Specialist IV
Water Quality Monitoring Section
Environmental Services Program

Date: ____

Approved by: ____

Celeste Koon
Acting Director
Environmental Services Program

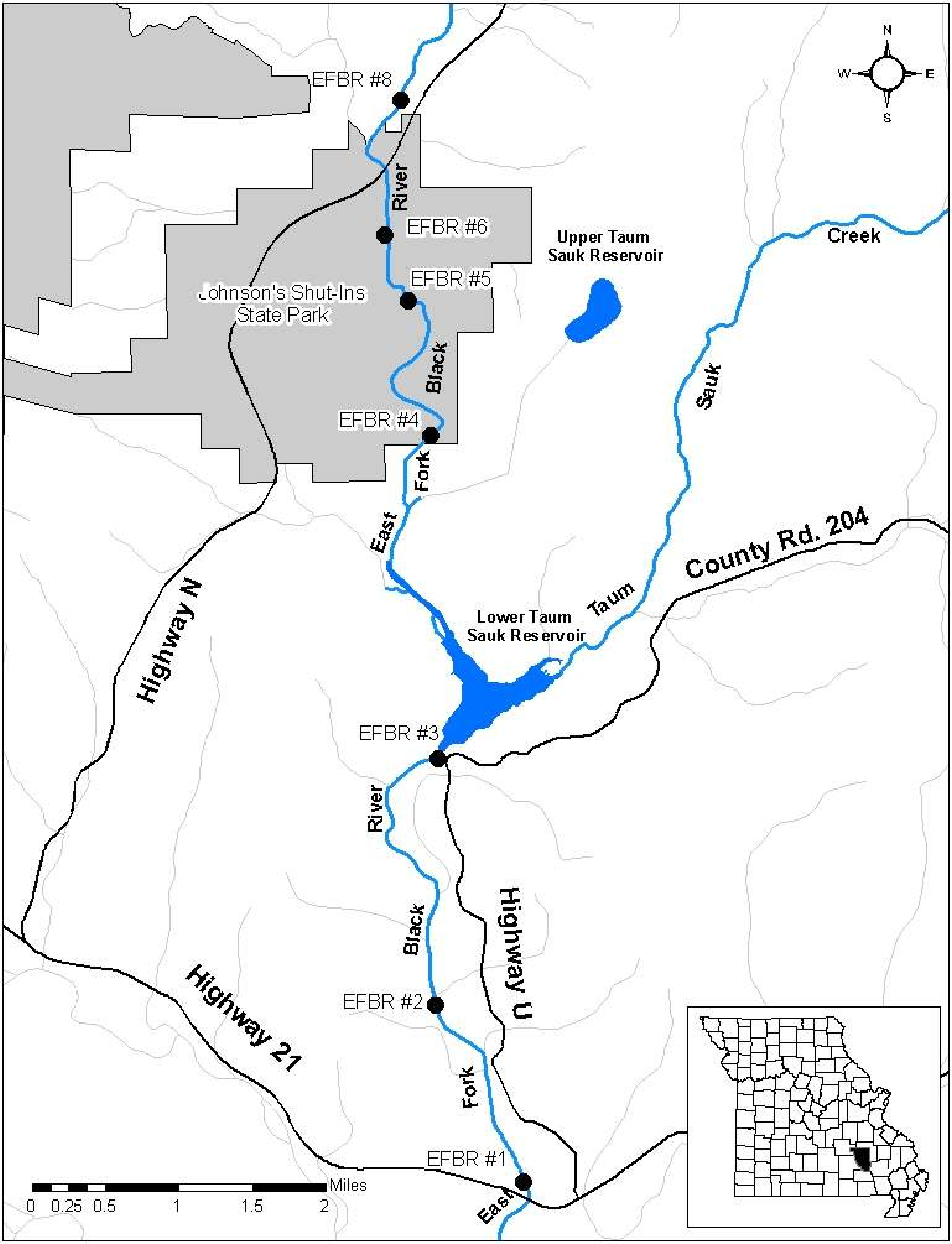
AR:dmt

c: Jackson Bostic, Regional Director, SERO
John Ford, QAPP Project Manager, WPP

Appendix A

Map

East Fork Black River Sample Stations
Ozark/Black/Current EDU



N
W
E
S
EFBR #8
River
EFBR #6
EFBR #5
Johnson's Shut-Ins
State Park
Black
EFBR #4
Fork
East
Upper Taum
Sauk Reservoir
Creek
Sauk
Taum
County Rd. 204
Lower Taum
Sauk Reservoir
Highway N
EFBR #3
River
Black
Highway U
EFBR #2
Highway 21
Fork
EFBR #1
East
0 0.25 0.5 1 1.5 2 Miles

Appendix B

East Fork Black River
Macroinvertebrate Taxa Lists

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0930049], Station #1a, Sample Date: 3/24/2009 4:00:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina		8	1
AMPHIPODA			
Allocrangonyx		2	
BRANCHIOBDELLIDA			
Branchiobdellida			1
COLEOPTERA			
Dubiraphia	4	10	
Macronychus glabratus			1
Microcylloepus pusillus	26	1	4
Optioservus sandersoni	4		
Psephenus herricki	3	1	
Stenelmis	10	5	2
DECAPODA			
Orconectes hylas	-99	-99	
Orconectes punctimanus			-99
DIPTERA			
Ablabesmyia		36	2
Ceratopogoninae	1	7	
Chironomidae	1		
Cladotanytarsus		4	
Corynoneura		1	2
Cricotopus bicinctus	3		4
Cricotopus/Orthocladius	12	10	18
Cryptochironomus		1	
Dicrotendipes		1	1
Eukiefferiella	29		22
Hemerodromia	5	1	1
Labrundinia		1	15
Microtendipes	1	3	
Nanocladius	1	1	1
Nilotanypus	3		1
Parakiefferiella		5	
Parametriocnemus	17	3	
Paratanytarsus		3	15
Phaenopsectra		2	
Polypedilum aviceps	11		
Polypedilum convictum	10		
Prosimulium	3		1
Psectrocladius			2
Rheocricotopus	8		2
Rheotanytarsus	106	2	47
Simulium	66		49
Stempellinella	3	20	
Tabanus	1		

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0930049], Station #1a, Sample Date: 3/24/2009 4:00:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Tanytarsus	18	40	4
Thienemannimyia grp.	3	9	4
EPHEMEROPTERA			
Acentrella			1
Acerpenna	2	1	1
Baetisca lacustris		1	
Caenis anceps		26	2
Caenis latipennis	2	3	17
Centroptilum			1
Ephemerella invaria	3		7
Eurylophella bicolor		10	
Eurylophella enoensis			4
Heptageniidae	10	9	3
Isonychia bicolor	55		18
Maccaffertium mediopunctatum	9	2	
Maccaffertium pulchellum	5	1	5
Stenacron		4	
Stenonema femoratum		27	
Tricorythodes	4	1	
HEMIPTERA			
Belostoma			-99
LIMNOPHILA			
Ancylidae		1	
Menetus	1		
LUMBRICINA			
Lumbricina	5	1	
MEGALOPTERA			
Corydalus	1	-99	
Nigronia serricornis	1		
ODONATA			
Argia	1		
Boyeria			-99
Enallagma			1
Gomphidae	2		
Hetaerina			2
Macromia			1
Neurocordulia			1
PLECOPTERA			
Amphinemura	7	1	5
Clioperla clio			1
Helopicus nalatus	-99		
Leuctridae	6	2	
Neoperla	11		
Perlesta	8		
Perlinella ephyre	1		
Prostoia			1

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0930049], Station #1a, Sample Date: 3/24/2009 4:00:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
TRICHOPTERA			
Ceratopsyche morosa grp	6		
Cheumatopsyche	5		
Chimarra	19	4	
Helicopsyche	2		
Oecetis			1
Oxyethira			18
Polycentropus		1	1
Ptilostomis			1
Pycnopsyche			-99
Triaenodes			2
TRICLADIDA			
Planariidae	2		
TUBIFICIDA			
Branchiura sowerbyi		4	
Enchytraeidae		1	
Tubificidae	1	2	
VENEROIDA			
Corbicula	4	-99	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0930048], Station #2, Sample Date: 3/24/2009 2:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	35	2	7
AMPHIPODA			
Allocrangonyx		1	
Hyalella azteca			5
COLEOPTERA			
Dubiraphia	1	7	10
Microcylloepus pusillus	34		17
Optioservus sandersoni	39		3
Psephenus herricki	4	-99	
Stenelmis	17		3
DECAPODA			
Orconectes hylas	-99		
Orconectes punctimanus			-99
DIPTERA			
Ablabesmyia		16	
Cardiocladius	2		
Ceratopogoninae		7	
Chironomidae		5	1
Cladotanytarsus		21	
Corynoneura	1	1	6
Cricotopus bicinctus	4		23
Cricotopus/Orthocladius	47	12	32
Cryptochironomus		6	
Cryptotendipes		3	
Dicrotendipes		2	
Eukiefferiella	23	1	
Hemerodromia	6		1
Labrundinia			8
Microtendipes	2	1	
Nanocladius	1	2	5
Nilotanypus			4
Pagastiella		3	
Paracladopelma		1	
Parakiefferiella		6	1
Parametriocnemus	6		
Paratanytarsus			17
Phaenopsectra			1
Polypedilum aviceps	10		
Polypedilum halterale grp		1	
Polypedilum illinoense grp		1	
Polypedilum scalaenum grp		1	
Procladius		7	
Psectrocladius			1
Rheocricotopus	7		

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0930048], Station #2, Sample Date: 3/24/2009 2:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Rheotanytarsus	88		36
Simulium	28		
Stempellinella	2	63	
Stictochironomus		3	
Tabanus	2		
Tanytarsus	16	63	4
Thienemannimyia grp.	8	4	5
Tribelos		1	
Tvetenia discoloripes grp	1		
EPHEMEROPTERA			
Acentrella	3		
Acerpenna	2		3
Caenis anceps	1	13	4
Caenis latipennis	3	7	44
Ephemerella invaria	7		
Eurylophella bicolor		2	1
Heptageniidae	17	1	1
Isonychia bicolor	106		-99
Maccaffertium mediopunctatum	18		
Maccaffertium pulchellum	20		1
Stenonema femoratum	-99	10	
Tricorythodes	16		2
LIMNOPHILA			
Menetus			2
LUMBRICINA			
Lumbricina	2		
MEGALOPTERA			
Corydalus	1		
ODONATA			
Argia	1		2
Boyeria			-99
Enallagma			1
Gomphidae	3		
PLECOPTERA			
Amphinemura	12		1
Helopicus nalatus	-99		
Isoperla	1		
Leuctridae	2	1	1
Neoperla	13		
Perlesta	2		2
Perlinella ephyre	2		
Prostoia	2		
Zealeuctra		1	
TRICHOPTERA			
Ceratopsyche morosa grp	5		
Cheumatopsyche	10		

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0930048], Station #2, Sample Date: 3/24/2009 2:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Chimarra	37		
Helicopsyche	2	1	
Nectopsyche			-99
Oecetis	2		4
Oxyethira	5	4	42
Polycentropus		2	2
Pycnopsyche			-99
Triaenodes			5
TRICLADIDA			
Planariidae	3		1
TUBIFICIDA			
Branchiura sowerbyi		-99	
VENEROIDA			
Pisidiidae	4	7	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0930047], Station #3, Sample Date: 3/24/2009 1:00:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina		6	11
AMPHIPODA			
Allocrangonyx		5	
Hyalella azteca			1
ARHYNCHOBDELLIDA			
Erpobdellidae	-99		
COLEOPTERA			
Dubiraphia		2	2
Scirtidae			1
Stenelmis	24	1	1
DECAPODA			
Orconectes hylas	1		2
DIPTERA			
Ablabesmyia		32	18
Ceratopogoninae		4	
Chironomidae	2		
Chironomus		2	
Cladotanytarsus		9	
Corynoneura			1
Cricotopus bicinctus	3	1	19
Cricotopus/Orthocladius	66	2	60
Cryptochironomus		6	
Dicrotendipes		2	
Djalmabatista		2	
Endochironomus		1	1
Eukiefferiella	24		2
Hemerodromia	4		1
Hydrobaenus		1	
Labrundinia			3
Nanocladius	16	2	7
Pagastiella		2	
Parachironomus	1		6
Parakiefferiella		2	3
Parametriocnemus	1		
Paratanytarsus		9	41
Polypedilum aviceps	10		2
Polypedilum convictum	5		
Polypedilum fallax grp	1		
Polypedilum halterale grp		1	
Polypedilum illinoense grp	2		11
Polypedilum scalaenum grp		4	
Potthastia			1
Procladius		4	
Prosimulium	1		

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0930047], Station #3, Sample Date: 3/24/2009 1:00:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Psectrocladius	5		9
Rheocricotopus	1		
Rheotanytarsus	360	5	43
Simulium	46		
Stempellinella		57	
Stenochironomus	1	2	2
Stictochironomus		1	
Tabanus	1		
Tanytarsus		91	18
Thienemanniella		4	2
Thienemannimyia grp.	1		2
Tribelos	2	1	1
Zavrelimyia			1
EPHEMEROPTERA			
Caenis latipennis	1	13	8
Centroptilum		1	
Ephemera simulans		1	
Ephemerella invaria	1		
Eurylophella bicolor		1	1
Eurylophella enoensis			1
Hexagenia limbata		-99	
Isonychia bicolor	18		
Leptophlebia			1
Maccaffertium mediopunctatum	1		
Maccaffertium pulchellum	11		
Serratella	1		
Stenacron	12		
Stenonema femoratum		2	
Tricorythodes	22		1
HEMIPTERA			
Ranatra kirkaldyi			2
Trichocorixa		1	
ISOPODA			
Caecidotea (Blind & Unpigmented)	1	1	
LIMNOPHILA			
Menetus			2
Physella			1
LUMBRICINA			
Lumbricina	-99		
MEGALOPTERA			
Corydalus	1		
ODONATA			
Argia	3	1	2
Enallagma			5
Gomphidae		1	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0930047], Station #3, Sample Date: 3/24/2009 1:00:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Hagenius brevistylus		1	
Macromia			2
PLECOPTERA			
Helopicus nalatus	-99		
Isoperla	1		
Perlesta	1		
Perlinella drymo		1	
Perlinella ephyre		1	
Strophopteryx	1		
TRICHOPTERA			
Cheumatopsyche	124		4
Chimarra	7	1	
Hydroptila	2		2
Neureclipsis			3
Oecetis			2
Oxyethira			13
Polycentropodidae		2	
Triaenodes			1
TRICLADIDA			
Planariidae	31		1
TUBIFICIDA			
Branchiura sowerbyi		-99	
Enchytraeidae		2	
Limnodrilus hoffmeisteri		1	
Tubificidae		1	
VENEROIDA			
Corbicula	9	3	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0930046], Station #4, Sample Date: 3/24/2009 11:45:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	22	11	3
BRANCHIOBDELLIDA			
Branchiobdellida	3		
COLEOPTERA			
Dubiraphia		1	5
Ectopria nervosa		1	
Optioservus sandersoni	12	3	2
Psephenus herricki	4	1	
Stenelmis	9	1	1
DECAPODA			
Orconectes hylas	-99		-99
Orconectes punctimanus			-99
DIPTERA			
Ablabesmyia		10	
Cardiocladius	2		
Ceratopogoninae	2	17	4
Cladotanytarsus		16	
Clinocera		1	
Corynoneura			20
Cricotopus bicinctus	1	1	21
Cricotopus/Orthocladius	13	32	58
Cryptochironomus		2	
Culicidae		1	
Dasyheleinae	1		
Eukiefferiella	11	1	
Hemerodromia	25	2	1
Hexatoma	33		
Labrundinia			4
Microtendipes	1	1	
Nanocladius		1	1
Nilotanypus			3
Pagastiella		1	
Parakiefferiella		1	
Parametriocnemus	33	1	
Paratanytarsus			10
Phaenopsectra		2	
Polypedilum aviceps	37		19
Polypedilum convictum	35	2	5
Polypedilum fallax grp			1
Polypedilum illinoense grp	2		1
Potthastia	3	25	7
Prosimulium	4		
Psectrocladius		2	
Pseudochironomus		1	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0930046], Station #4, Sample Date: 3/24/2009 11:45:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Rheocricotopus	5		18
Rheotanytarsus	11	2	44
Simulium	8		
Stempellinella		8	2
Tabanus	9		
Tanytarsus	29	23	7
Thienemanniella		2	2
Thienemannimyia grp.	6	9	25
EPHEMEROPTERA			
Acentrella	12		1
Acerpenna			1
Anthopotamus	1		
Caenis anceps		11	7
Caenis latipennis	5	11	26
Callibaetis		1	
Centroptilum			1
Ephemerella	1		1
Eurylophella	1	4	5
Heptageniidae	16		
Isonychia bicolor	33	-99	
Leptophlebia			-99
Maccaffertium bednariki	4		
Maccaffertium mediopunctatum	7	1	5
Maccaffertium pulchellum	13		7
Stenacron	1		
Stenonema femoratum		2	2
Tricorythodes	1		1
LEPIDOPTERA			
Petrophila	1		
LUMBRICINA			
Lumbricina		-99	
LUMBRICULIDA			
Lumbriculidae	1		
MEGALOPTERA			
Corydalus	1	1	
ODONATA			
Boyeria			1
Calopteryx			1
Gomphidae	2		
Hagenius brevistylus		1	-99
PLECOPTERA			
Amphinemura	2		1
Isoperla	3		
Leuctridae	3	1	
Neoperla	43	2	11
TRICHOPTERA			

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0930046], Station #4, Sample Date: 3/24/2009 11:45:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Ceratopsyche morosa grp	8		
Cheumatopsyche	72		2
Chimarra	10		
Helicopsyche	9	1	7
Hydropsyche	1		
Hydroptila		1	7
Oecetis		4	4
Oxyethira			1
Polycentropodidae	1		
Ptilostomis			-99
Pycnopsyche			-99
Rhyacophila	1		
Triaenodes			1
TRICLADIDA			
Planariidae	7		

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0930051], Station #5, Sample Date: 3/25/2009 10:00:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	8	9	
AMPHIPODA			
Gammarus			1
Stygobromus		1	
BRANCHIOBDELLIDA			
Branchiobdellida			1
COLEOPTERA			
Dubiraphia		12	
Optioservus sandersoni	8		
Paracymus	1		
Psephenus herricki	4	1	
Scirtidae			1
Stenelmis		2	
DECAPODA			
Orconectes hylas			2
DIPTERA			
Ablabesmyia	1	11	2
Ceratopogoninae	6	32	2
Chironomidae		1	
Cladotanytarsus		18	
Clinocera	1	2	
Corynoneura	1	2	
Cricotopus bicinctus	2		
Cricotopus/Orthocladius	23	10	2
Cryptochironomus		7	
Dasyheleinae		1	
Dicrotendipes		2	
Diptera		2	
Dixella			1
Eukiefferiella	3		1
Hemerodromia	8		1
Labrundinia			1
Nilotanypus	1		
Ormosia		5	
Pagastiella		6	
Paracladopelma		3	
Parakiefferiella		11	
Parametriocnemus	12	2	
Paratendipes		1	
Pericoma		1	
Phaenopsectra	2	6	
Polypedilum aviceps	89	1	3
Polypedilum convictum	11		1
Polypedilum illinoense grp	3		3

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0930051], Station #5, Sample Date: 3/25/2009 10:00:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Polypedilum scalaenum grp		4	
Potthastia	6	12	1
Prosimulium	14		3
Pseudosmittia		1	
Psilometriocnemus		2	1
Rheocricotopus	6		
Rheotanytarsus	14		1
Simulium	30		7
Stempellinella		23	
Stictochironomus		10	
Tabanus	6		
Tanytarsus	23	15	1
Thienemannimyia grp.	4	4	
Tipula			-99
EPHEMEROPTERA			
Acentrella	8		
Acerpenna	3		
Caenis anceps	1	33	
Caenis latipennis		18	
Centroptilum			1
Eurylophella	3	1	
Isonychia bicolor	5		
Leptophlebia			3
Maccaffertium mediopunctatum	2		
Maccaffertium pulchellum	8		-99
Stenacron	2	1	1
Stenonema femoratum	9	1	
ISOPODA			
Caecidotea (Blind & Unpigmented)		1	
Lirceus			1
LIMNOPHILA			
Physella			2
LUMBRICINA			
Lumbricina		-99	
ODONATA			
Calopteryx			1
Enallagma	1		
Gomphidae	1		
PLECOPTERA			
Acroneuria	2		1
Amphinemura	14		3
Helopicus nalatus	1		
Isoperla	12		1
Leuctridae	4		
Perlidae	4		

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0930051], Station #5, Sample Date: 3/25/2009 10:00:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
TRICHOPTERA			
Ceratopsyche morosa grp	6		
Cheumatopsyche	16		1
Chimarra	4		
Helicopsyche	7		
Hydroptila		1	1
Polycentropus	4	1	
Pycnopsyche			2
TUBIFICIDA			
Enchytraeidae		3	
Limnodrilus hoffmeisteri		1	
Tubificidae	3	10	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0930052], Station #6, Sample Date: 3/25/2009 11:40:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	10	1	14
AMPHIPODA			
Hyalella azteca			6
BRANCHIOBDELLIDA			
Branchiobdellida		1	3
COLEOPTERA			
Dubiraphia		5	2
Neoporus			1
Optioservus sandersoni	13	1	
Paracymus		1	
Psephenus herricki	6	3	
Stenelmis	2		
DECAPODA			
Orconectes hylas		1	
Orconectes punctimanus			-99
DIPTERA			
Ablabesmyia		13	1
Cardiocladius	1		
Ceratopogoninae		4	1
Chaetocladius		1	6
Chironomidae	4	3	4
Cladotanytarsus		3	
Clinocera	13		
Corynoneura			6
Cricotopus bicinctus	2		1
Cricotopus/Orthocladius	37	14	28
Cryptochironomus		3	1
Dasyheleinae	1		
Dicrotendipes	1	3	5
Eukiefferiella	5		
Hemerodromia	4	1	
Labrundinia		2	7
Micropsectra	8		
Microtendipes	1		1
Natarsia		4	1
Ormosia		2	
Pagastiella		1	
Parakiefferiella	1	5	1
Parametriocnemus	36		
Paratanytarsus			14
Polypedilum aviceps	76	5	
Polypedilum convictum	4		
Polypedilum fallax grp		1	
Polypedilum illinoense grp		2	1

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0930052], Station #6, Sample Date: 3/25/2009 11:40:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Potthastia	54	7	5
Prosimulium	2		
Psectrocladius		1	4
Pseudolimnophila			1
Rheocricotopus	4	3	
Rheotanytarsus	33	2	1
Robackia	1		
Simulium	5		
Stempellinella	3	14	
Stictochironomus		3	
Stilocladius			2
Tabanus	9		
Tanytarsus	49	10	2
Thienemannimyia grp.	28	4	3
Tribelos		7	
Tvetenia	1		
Zavrelimyia		3	
EPHEMEROPTERA			
Acentrella	4		
Acerpenna	9		
Caenis anceps		5	
Caenis latipennis	24	13	4
Centroptilum			16
Eurylophella bicolor	9	1	
Eurylophella enoensis			3
Heptageniidae	16		
Isonychia bicolor	19		
Leptophlebia			1
Maccaffertium mediopunctatum	3		
Maccaffertium pulchellum	13		
Stenacron	5	1	
Stenonema femoratum	4	10	
ISOPODA			
Caecidotea (Blind & Unpigmented)			10
Lirceus	1		1
LIMNOPHILA			
Fossaria			1
Physella	1		
LUMBRICINA			
Lumbricina	1	1	
ODONATA			
Argia	1		
Enallagma			3
Gomphidae		1	
PLECOPTERA			

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0930052], Station #6, Sample Date: 3/25/2009 11:40:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Amphinemura	1	1	
Helopicus nalatus	1		
Hydroperla	2		
Isoperla	5		
Leuctridae	24		1
Neoperla	4		
TRICHOPTERA			
Agapetus	1		
Ceratopsyche morosa grp	1		
Cheumatopsyche	34		
Chimarra	5		
Helicopsyche	5		1
Hydroptila	1		2
Leptoceridae	1		
Oecetis		1	
Polycentropus	6	1	
Pycnopsyche		-99	4
Triaenodes			5
TRICLADIDA			
Planariidae	2		1
TUBIFICIDA			
Enchytraeidae	1	2	1
Limnodrilus hoffmeisteri		13	
Tubificidae		10	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0930053], Station #8, Sample Date: 3/25/2009 1:00:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	7	6	
AMPHIPODA			
Hyalella azteca			14
BRANCHIOBDELLIDA			
Branchiobdellida	1	9	
COLEOPTERA			
Dubiraphia	1	6	2
Dytiscidae		1	
Helichus lithophilus			1
Optioservus sandersoni	9	2	1
Psephenus herricki	9		
Scirtidae			2
Stenelmis	15	3	
DECAPODA			
Orconectes hylas		1	2
DIPTERA			
Ablabesmyia		4	1
Antocha	1		
Ceratopogoninae	3	45	7
Chironomidae	1	1	1
Chrysops	-99		
Cladotanytarsus	4	33	
Corynoneura	2	5	1
Cricotopus bicinctus			1
Cricotopus/Orthocladius	4	10	7
Cryptochironomus		1	
Dicrotendipes	1	3	2
Dixella			2
Ephydridae	1		
Eukiefferiella	6	2	1
Hemerodromia	1		1
Labrundinia			2
Micropsectra	1	2	
Nilotanypus			1
Orthocladius (Euorthocladius)		1	
Pagastiella		3	
Parakiefferiella		10	1
Paramerina			1
Parametriocnemus	14	6	
Paratanytarsus	1	1	8
Phaenopsectra			11
Polypedilum aviceps	17		
Polypedilum convictum	23	3	
Polypedilum fallax grp			8

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0930053], Station #8, Sample Date: 3/25/2009 1:00:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Polypedilum illinoense grp	1		1
Polypedilum scalaenum grp		1	1
Potthastia	13	10	3
Prosimulium	70		
Psectrocladius		1	1
Pseudochironomus		1	
Rheocricotopus	3	1	
Rheotanytarsus	11		3
Simulium	21		
Stempellinella	4	16	2
Tabanus	1	-99	
Tanytarsus	31	42	6
Thienemanniella	2	2	
Thienemannimyia grp.	6	22	7
Tipula	2		
undescribed Empididae		1	
EPHEMEROPTERA			
Acentrella	9		
Baetis	1		
Baetisca lacustris	1		1
Caenis latipennis	8	15	10
Centroptilum	1		3
Eurylophella bicolor	8	1	11
Eurylophella enoensis			2
Isonychia bicolor	18		
Leptophlebiidae		2	
Maccaffertium mediopunctatum	6		
Maccaffertium pulchellum	16		
Maccaffertium vicarium	2		
Stenacron	11	5	
Stenonema femoratum	4	2	4
ISOPODA			
Caecidotea	2		
Lirceus	5		3
LIMNOPHILA			
Ancylidae	1		
Lymnaeidae			1
Menetus		1	
Physella	1		
LUMBRICINA			
Lumbricina		4	
LUMBRICULIDA			
Lumbriculidae	1	-99	1
ODONATA			
Argia	3	7	1
Enallagma			3

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0930053], Station #8, Sample Date: 3/25/2009 1:00:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Gomphidae	1		1
Gomphus		1	
Hagenius brevistylus			1
Macromia			1
PLECOPTERA			
Acroneuria	1		
Helopicus nalatus	-99		
Isoperla	2		1
Leuctridae	62	28	3
Neoperla	1		
Perlesta	4	1	1
Perlinella drymo	1		
Perlinella ephyre		1	
TRICHOPTERA			
Ceratopsyche morosa grp	1		
Cheumatopsyche	55		
Chimarra	4	1	
Helicopsyche	9		
Hydroptila	1	2	
Mystacides	1		
Neureclipsis	2		
Oecetis	2		1
Polycentropodidae	2	1	
Pycnopsyche			1
Triaenodes			4
TRICLADIDA			
Planariidae	3		1
TUBIFICIDA			
Tubificidae	1		1

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0918423], Station #1, Sample Date: 9/23/2009 10:30:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	19	8	6
AMPHIPODA			
Hyalella azteca		1	18
COLEOPTERA			
Dubiraphia		6	19
Helichus lithophilus			1
Microcylloepus pusillus	11	1	7
Optioservus sandersoni	14	2	
Psephenus herricki	1	2	
Stenelmis	64	15	18
DECAPODA			
Orconectes hylas		-99	-99
Orconectes virilis		-99	
DIPTERA			
Ablabesmyia		17	17
Cardiocladius	3		
Ceratopogoninae		5	2
Chironomidae	1	3	2
Chironomus		1	
Cladopelma		1	
Cladotanytarsus	1	10	1
Corynoneura	1	3	
Cricotopus/Orthocladius	4		39
Dicrotendipes	2	7	3
Hydrobaenus			1
Labrundinia			6
Larsia			1
Microtendipes	1	1	
Nanocladius	7	3	1
Nilothauma	1		
Parakiefferiella	3	3	
Paramerina			1
Paratanytarsus		4	12
Phaenopsectra		3	
Polypedilum aviceps	8		
Procladius		1	
Psectrocladius			2
Pseudochironomus	3		
Rheotanytarsus	60		2
Simulium	9		1
Stempellinella		6	6
Stenochironomus	2	8	1
Stictochironomus		1	
Tanytarsus	19	24	21

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0918423], Station #1, Sample Date: 9/23/2009 10:30:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Thienemanniella	1		
Thienemannimyia grp.	1	2	2
Tribelos		8	
Xestochironomus			1
EPHEMEROPTERA			
Acentrella	4		
Baetis	2		
Baetiscidae	1	2	
Caenis anceps	27	12	
Caenis latipennis		9	64
Centroptilum			19
Choroterpes		1	
Ephemera		1	
Eurylophella	1		
Isonychia bicolor	94		
Leptophlebiidae		3	1
Leucrocuta	4		
Maccaffertium bednariki	5		
Maccaffertium mediopunctatum	29		
Maccaffertium pulchellum	16		
Procloeon		1	3
Stenacron	8	6	
Stenonema femoratum	3	82	4
Tricorythodes	43		2
LUMBRICINA			
Lumbricina	5	3	
LUMBRICULIDA			
Lumbriculidae		3	
MEGALOPTERA			
Corydalus	9		
ODONATA			
Argia	23	13	8
Boyeria			-99
Enallagma			14
Gomphidae	1	1	
Hagenius brevistylus		2	
Hetaerina			1
Macromia		1	1
PLECOPTERA			
Neoperla	4		
TRICHOPTERA			
Cheumatopsyche	3		
Chimarra	13	1	1
Helicopsyche	4		
Oecetis		1	13
Oxyethira		1	8

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0918423], Station #1, Sample Date: 9/23/2009 10:30:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Polycentropus			1
Triaenodes			7
TRICLADIDA			
Planariidae	20	2	
TUBIFICIDA			
Tubificidae	4	2	
VENEROIDA			
Corbicula	13	37	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0918424], Station #2a, Sample Date: 9/22/2009 5:35:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	24	14	34
AMPHIPODA			
Hyalella azteca			13
Stygobromus		2	
COLEOPTERA			
Dubiraphia		7	14
Ectopria nervosa		2	5
Macronychus glabratus			2
Microcylloepus pusillus	2		5
Optioservus sandersoni	21	3	
Psephenus herricki	11	3	
Stenelmis	73	51	7
DECAPODA			
Orconectes hylas	1		
DIPTERA			
Ablabesmyia	2	16	11
Anopheles			2
Cardiocladius	1		
Ceratopogoninae		14	6
Chironomidae	1	3	
Chironomus	1		
Cladopelma		3	
Cladotanytarsus	2	6	1
Corynoneura		2	
Cricotopus/Orthocladius	3		24
Cryptochironomus	1		
Cryptotendipes		2	
Dicrotendipes	2	6	8
Empididae		1	
Labrundinia			3
Larsia	1		
Microtendipes	1		1
Nanocladius	2		1
Paralauterborniella	1		
Paratanytarsus			19
Phaenopsectra			1
Polypedilum		1	
Polypedilum aviceps	3		
Polypedilum halterale grp		1	
Procladius		6	
Psectrocladius		1	
Pseudochironomus	2	2	
Rheotanytarsus	2		
Stempellina		2	1

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0918424], Station #2a, Sample Date: 9/22/2009 5:35:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Stempellinella	1	6	
Stenochironomus			2
Tanytarsus	9	17	11
Thienemanniella	1		
Thienemannimyia grp.	1	1	2
Tribelos	14	1	
EPHEMEROPTERA			
Acerpenna	1		
Baetis	2		
Caenis anceps	34		54
Caenis latipennis	9	8	
Centroptilum		2	4
Choroterpes		1	
Ephemera simulans		2	
Hexagenia limbata		1	
Isonychia bicolor	93		
Leptophlebiidae		3	
Leucrocuta	2		
Maccaffertium bednariki	1		
Maccaffertium mediopunctatum	34		
Maccaffertium pulchellum	18		
Procloeon			9
Stenacron	19	1	
Stenonema femoratum	3	15	
Tricorythodes	127		
HAPLOTAXIDA			
Haplotaxis		1	
ISOPODA			
Caecidotea		6	
Lirceus	1		
LEPIDOPTERA			
Petrophila	2		
LIMNOPHILA			
Ancylidae	1		3
Helisoma			-99
Lymnaeidae		1	1
Menetus	1	8	24
Physella		2	
LUMBRICINA			
Lumbricina		1	
LUMBRICULIDA			
Lumbriculidae	1		
MEGALOPTERA			
Corydalus	6		
Nigronia serricornis			-99
ODONATA			

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0918424], Station #2a, Sample Date: 9/22/2009 5:35:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Argia	14	1	5
Enallagma			29
Hagenius brevistylus		2	
Macromia			-99
PLECOPTERA			
Acroneuria	1		
Neoperla	3	4	
Perlinella ephyre		1	
TRICHOPTERA			
Cernotina			2
Cheumatopsyche	4		
Chimarra	5		
Helicopsyche	4		
Nyctiophylax			6
Oecetis	1		10
Oxyethira	5	1	
Polycentropus		3	
Triaenodes			10
TRICLADIDA			
Planariidae	11	1	2
TUBIFICIDA			
Tubificidae	1	3	
VENEROIDA			
Corbicula	22	33	5

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0918426], Station #3, Sample Date: 9/22/2009 2:15:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	13	2	1
AMPHIPODA			
Allocrangonyx	6	1	
Hyalella azteca			1
Stygobromus		1	
COLEOPTERA			
Berosus	2		
Dubiraphia	10	1	
Enochrus	1		
Stenelmis	6	4	
DECAPODA			
Orconectes hylas		-99	
Orconectes virilis			-99
DIPTERA			
Ablabesmyia	22	5	9
Ceratopogoninae	8	4	41
Chironomus	40	5	
Cladopelma	38	6	
Cladotanytarsus	6	3	
Cricotopus/Orthocladius	1	15	11
Cryptochironomus	24	1	
Dicrotendipes	14	1	12
Epoicocladius	1		
Glyptotendipes	1		
Hemerodromia		1	
Nanocladius	4	11	6
Parachironomus	1	11	1
Parakiefferiella	2	1	
Paratanytarsus	8	2	37
Phaenopsectra	1		
Polypedilum halterale grp	1		
Polypedilum illinoense grp		1	3
Procladius	5	2	
Pseudochironomus	9	2	6
Rheotanytarsus	12	46	6
Simulium		6	
Stempellina	3	2	
Stempellinella	15	3	
Stenochironomus	3	2	
Stictochironomus	3		
Tanytarsus	148	11	33
Thienemannimyia grp.			1
Tribelos	1		
Zavrelimyia	2		

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0918426], Station #3, Sample Date: 9/22/2009 2:15:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
EPHEMEROPTERA			
Baetis		2	1
Caenis anceps	142	21	10
Caenis latipennis	14	3	59
Centroptilum			2
Ephemera simulans	2	-99	
Hexagenia limbata	5		
Isonychia bicolor		6	
Maccaffertium mediopunctatum		4	
Maccaffertium pulchellum		8	
Procloeon	1		
Stenacron	6	16	
Stenonema femoratum	5	3	
Tricorythodes		49	
ISOPODA			
Caecidotea		2	
LIMNOPHILA			
Ancylidae	2		2
Menetus			28
LUMBRICINA			
Lumbricina	-99	-99	
MEGALOPTERA			
Corydalus		1	
ODONATA			
Argia	1	23	2
Enallagma			24
Gomphidae	2	3	
Hagenius brevistylus		1	
Macromia	1		-99
TRICHOPTERA			
Cheumatopsyche		36	
Hydroptila			1
Nyctiophylax		1	
Oecetis	4		4
Oxyethira			1
Polycentropus	2	1	2
Triaenodes			2
TRICLADIDA			
Planariidae	2	90	1
TUBIFICIDA			
Branchiura sowerbyi	3	1	
Tubificidae	4	1	
VENEROIDA			
Corbicula	10	7	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0918427], Station #4, Sample Date: 9/22/2009 12:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	14		
COLEOPTERA			
Dubiraphia		6	14
Helichus lithophilus			1
Microcylloepus pusillus			7
Optioservus sandersoni	22		1
Psephenus herricki	34		
Stenelmis	29	7	1
DECAPODA			
Orconectes hylas	-99	-99	
DIPTERA			
Ablabesmyia		8	5
Apedilum		1	
Ceratopogoninae	2	32	12
Chironomidae		2	
Cladotanytarsus		2	2
Cricotopus/Orthocladius	42	2	35
Cryptochironomus		3	1
Dasyheleinae			4
Dicrotendipes	1	1	1
Eukiefferiella	1		
Forcipomyiinae		3	3
Hemerodromia	6		
Hexatoma	5		1
Labrundinia		2	7
Limonia			3
Nanocladius	1	1	1
Parakiefferiella	1	3	3
Paralauterborniella		1	
Parametriocnemus	2		
Paratanytarsus			86
Phaenopsectra		4	
Polypedilum convictum	36		3
Polypedilum illinoense grp			9
Polypedilum scalaenum grp		1	
Procladius		2	
Pseudochironomus		12	3
Rheotanytarsus	57	1	15
Simulium	17	4	1
Stempellina		1	
Stempellinella	5	4	
Stenochironomus		2	
Stictochironomus		2	
Tabanus	5		

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0918427], Station #4, Sample Date: 9/22/2009 12:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Tanytarsus	25	15	15
Thienemanniella	2		
Thienemannimyia grp.	10	1	30
Tribelos		4	
Zavrelimyia		9	
EPHEMEROPTERA			
Acentrella	9		1
Acerpenna		1	1
Baetis	2		
Caenis anceps	17	22	
Caenis latipennis		22	4
Centroptilum		2	4
Choroterpes	6		
Ephemera		-99	
Eurylophella			2
Hexagenia limbata		1	
Isonychia bicolor	38		1
Leptophlebiidae		7	
Leucrocuta	1		
Maccaffertium bednariki	1		
Maccaffertium mediopunctatum	26		
Maccaffertium pulchellum	26		2
Procloeon		1	2
Stenacron	4	2	
Stenonema femoratum	12	27	9
Tricorythodes	21		7
HEMIPTERA			
Microvelia			1
Rhagovelia			1
LEPIDOPTERA			
Petrophila	3		
LIMNOPHILA			
Ancylidae			1
Lymnaeidae			1
Menetus			1
Physella		4	
LUMBRICINA			
Lumbricina	4	2	
MEGALOPTERA			
Corydalus	1		
ODONATA			
Argia	12	3	
Boyeria			1
Enallagma			3
Gomphidae	2		
Hagenius brevistylus		1	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0918427], Station #4, Sample Date: 9/22/2009 12:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
PLECOPTERA			
Neoperla	3		
Perlinella ephyre	2		
Zealeuctra			1
TRICHOPTERA			
Ceratopsyche morosa grp	2		
Cheumatopsyche	28		
Chimarra	9		
Helicopsyche	77	1	1
Hydroptila	1	2	2
Oecetis	7	1	14
Oxyethira			1
Polycentropus	1		
Triaenodes			12
TRICLADIDA			
Planariidae	11	1	
TUBIFICIDA			
Enchytraeidae	2		

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0918428], Station #5, Sample Date: 9/23/2009 12:40:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	10	2	5
AMPHIPODA			
Hyalella azteca			37
BRANCHIOBDELLIDA			
Branchiobdellida	1		
COLEOPTERA			
Dubiraphia		31	1
Dytiscus		1	
Helichus basalis			1
Helichus lithophilus			3
Microcylloepus pusillus	1		20
Optioservus sandersoni	18		
Psephenus herricki	15	1	
Stenelmis	4		
DECAPODA			
Orconectes hylas	-99	1	2
Orconectes punctimanus			1
DIPTERA			
Ablabesmyia		12	
Cardiocladius	4	1	
Chironomidae	2	1	
Chironomus		2	
Cladotanytarsus		16	
Corynoneura			2
Cricotopus/Orthocladius	25	4	5
Cryptochironomus		1	
Dicrotendipes	1	1	2
Djalmabatista	1	1	
Epoicocladius		1	
Forcipomyiinae	1		
Hemerodromia	7		1
Larsia			1
Microtendipes		2	
Nanocladius	3		
Nilotanypus	2		1
Parakiefferiella		2	
Paralauterborniella		1	
Parametriocnemus	3		
Paratanytarsus			1
Phaenopsectra		12	
Polypedilum aviceps	36		5
Polypedilum convictum	3		
Polypedilum illinoense grp			1
Procladius		2	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0918428], Station #5, Sample Date: 9/23/2009 12:40:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Pseudochironomus		2	1
Rheotanytarsus	36	1	52
Simulium	55		19
Stempellinella	1	6	
Stictochironomus		6	
Tabanus	3	1	1
Tanytarsus	7	13	4
Thienemanniella	1		
Thienemannimyia grp.	2	2	14
Tipula			1
Tribelos		3	
EPHEMEROPTERA			
Acentrella	10		1
Acerpenna	1		1
Baetis	6		8
Baetisca lacustris	1		
Caenis anceps	5	51	
Caenis latipennis		23	3
Centroptilum		1	
Choroterpes		2	
Eurylophella			1
Heptageniidae	56		
Hexagenia limbata		2	
Isonychia bicolor	107		17
Leptophlebiidae	1	4	
Leucrocuta	1		
Maccaffertium mediopunctatum	31		4
Maccaffertium pulchellum	18		10
Stenacron	2	3	
Stenonema femoratum	10	35	
Tricorythodes	2		
HEMIPTERA			
Microvelia			2
Trepobates			1
ISOPODA			
Lirceus	1		
LEPIDOPTERA			
Petrophila	1		2
LIMNOPHILA			
Ancylidae	2		
Lymnaeidae			1
Physella	1	2	9
LUMBRICINA			
Lumbricina	2	-99	
MEGALOPTERA			
Corydalus	4		

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0918428], Station #5, Sample Date: 9/23/2009 12:40:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
ODONATA			
Argia	8	6	12
Boyeria			1
Calopteryx			10
Enallagma			6
Gomphidae	4	1	
Hagenius brevistylus	-99	2	
Macromia		-99	
Stylogomphus albistylus	-99		
PLECOPTERA			
Neoperla	1		
Perlinella ephyre		1	
TRICHOPTERA			
Ceratopsyche morosa grp	1		
Cheumatopsyche	69		8
Chimarra	5		1
Helicopsyche	63	4	3
Oecetis			4
Polycentropus	2		
Triaenodes			8
TRICLADIDA			
Planariidae	6	1	6
TUBIFICIDA			
Enchytraeidae		1	
Tubificidae		3	1

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0918429], Station #6, Sample Date: 9/23/2009 2:50:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	17	2	28
AMPHIPODA			
Hyalella azteca			107
BRANCHIOBDELLIDA			
Branchiobdellida	16		
COLEOPTERA			
Berosus		1	7
Dubiraphia		14	15
Ectopria nervosa		1	1
Helichus lithophilus			-99
Heterosternuta		3	
Optioservus sandersoni	22	1	
Paracymus		1	
Psephenus herricki	27	7	
Stenelmis	9	10	
DECAPODA			
Orconectes hylas	-99		
Orconectes punctimanus			-99
DIPTERA			
Ablabesmyia	1	30	2
Cardiocladius			1
Ceratopogoninae	1	1	1
Chironomidae		10	
Chironomus		2	
Cladotanytarsus		34	
Corynoneura		4	
Cricotopus/Orthocladius	6	3	1
Cryptochironomus		29	
Dicrotendipes	1	5	1
Djalmabatista		1	
Hemerodromia	2		
Labrundinia			4
Limonia		1	
Microtendipes		2	
Nanocladius	1	2	
Paracladopelma		1	
Paramerina		1	
Parametriocnemus	2		
Paraphaenocladius		1	
Paratanytarsus			16
Paratendipes		1	
Polypedilum aviceps	2		
Polypedilum convictum	18	1	1
Polypedilum halterale grp	1		

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0918429], Station #6, Sample Date: 9/23/2009 2:50:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Polypedilum illinoense grp		1	1
Polypedilum scalaenum grp		1	
Protoplasa fitchii		1	
Psectrocladius			6
Pseudochironomus		2	
Rheotanytarsus	13		
Simulium	2		
Stempellinella	2	27	1
Stictochironomus		16	
Tabanus	1		
Tanytarsus	15	20	2
Thienemannimyia grp.	3	4	2
Tribelos		12	1
EPHEMEROPTERA			
Acentrella	12		
Acerpenna	1	1	
Baetis	8		
Baetiscidae	1		
Caenis anceps	8	15	
Caenis latipennis	1	8	14
Callibaetis			2
Centroptilum		3	4
Choroterpes		2	
Eurylophella	2		
Isonychia bicolor	59		
Leptophlebiidae	2	31	1
Leucrocuta	7		
Maccaffertium mediopunctatum	27		
Maccaffertium pulchellum	61	1	
Procloeon		2	6
Stenacron	21		
Stenonema femoratum	18	53	
Tricorythodes	16		1
GORDIOIDEA			
Gordiidae	-99		
HEMIPTERA			
Rhagovelia		1	
LIMNOPHILA			
Ancylidae	2		
Helisoma			1
Lymnaeidae		2	
Menetus			2
Physella		-99	1
LUMBRICINA			
Lumbricina	9	1	
LUMBRICULIDA			

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0918429], Station #6, Sample Date: 9/23/2009 2:50:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Lumbriculidae		4	
MEGALOPTERA			
Corydalus	1		
ODONATA			
Argia	12	2	18
Enallagma			45
Gomphidae		2	
Libellula			1
Stylogomphus albistylus		-99	
PLECOPTERA			
Neoperla	2		
Perlinella ephyre	1	1	
Zealeuctra	6		
TRICHOPTERA			
Ceratopsyche morosa grp	2		
Cheumatopsyche	95		1
Chimarra	14		
Helicopsyche	68		1
Oecetis	2		5
Oxyethira			2
Triaenodes			28
TRICLADIDA			
Planariidae	13		1
TUBIFICIDA			
Tubificidae		7	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0918430], Station #8, Sample Date: 9/23/2009 4:35:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	12	6	2
AMPHIPODA			
Hyalella azteca			3
BRANCHIOBDELLIDA			
Branchiobdellida	13		
COLEOPTERA			
Dubiraphia		12	
Microcylloepus pusillus	1		
Optioservus sandersoni	21	3	
Oreodytes		1	
Psephenus herricki	10	2	
Stenelmis	56	19	
DECAPODA			
Orconectes hylas	2	1	
DIPTERA			
Ablabesmyia		7	10
Anopheles			3
Ceratopogoninae	1	3	2
Chironomidae		5	2
Cladotanytarsus		1	
Corynoneura		1	9
Cricotopus/Orthocladius	7	2	15
Cryptochironomus		2	
Dicrotendipes			2
Dixella			1
Forcipomyiinae	1		2
Hemerodromia	2		
Labrundinia			4
Microtendipes		2	
Nanocladius		1	
Nilotanypus	1		
Parametriocnemus	2		
Paratanytarsus			17
Polypedilum aviceps	2		
Polypedilum convictum	29	1	
Polypedilum illinoense grp	1		3
Rheocricotopus	1		
Rheotanytarsus	8	1	
Simulium	13		
Stempellinella		16	1
Tabanus		-99	
Tanytarsus	1	14	16
Thienemanniella	1	1	3
Thienemannimyia grp.	1	7	4

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0918430], Station #8, Sample Date: 9/23/2009 4:35:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Tribelos		9	
EPHEMEROPTERA			
Acentrella	22		
Baetis	8		
Baetisca lacustris	1	3	
Caenis anceps	4	28	2
Caenis latipennis	3	1	
Callibaetis		1	
Choroterpes		2	
Eurylophella	1	8	
Isonychia bicolor	21		
Leptophlebiidae		11	2
Leucrocuta	2		
Maccaffertium pulchellum	42		
Procloeon		3	4
Stenacron	10	13	
Stenonema femoratum	10	66	1
Tricorythodes	1		
ISOPODA			
Caecidotea	6		
LIMNOPHILA			
Ancylidae		2	
Lymnaeidae			2
Menetus	1	1	
Physella		1	1
LUMBRICINA			
Lumbricina	6	3	
LUMBRICULIDA			
Lumbriculidae	2		
MEGALOPTERA			
Corydalus	3		
Nigronia serricornis	1		
ODONATA			
Argia	8	20	
Enallagma		1	13
Gomphidae	3	2	
Hagenius brevistylus		2	
Macromia			1
Stylogomphus albistylus		1	
PLECOPTERA			
Leuctra	9	2	
Neoperla	3		
TRICHOPTERA			
Cheumatopsyche	13		
Chimarra	29		
Helicopsyche	6	1	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0918430], Station #8, Sample Date: 9/23/2009 4:35:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Nectopsyche		1	1
Oecetis	1		1
Polycentropus	4	3	
TRICLADIDA			
Planariidae	24	1	
TUBIFICIDA			
Aulodrilus		1	
Limnodrilus hoffmeisteri		1	